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FEB 79 J VALENZUELA, W EICHELBERGER N66001-78-R-0318

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AVAILABILITY STUDY OF THE AN/WLR-1G AND AN/SLQ-32(V)2 ELECTRONIC SUPPORT MEASURE (ESM) SYSTEMS CDRL A001

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Meantime between failure and meantime to repair studies were conducted for the AN/WLR-IG and the AN/SLQ-32(V)2 systems. The AN/WLR-IG studies were based on data in the Navy 3M logistical reporting system. AN/SLQ-32(V)2 analyses were based on limited operational evaluation data. Equipment availability and supporting MTBF and MTTR data are given for different operating modes.

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EXECUTIVE SUMMARY

Objective

The objective of this study was to analyze the AN/WLR-1G and the AN/SLQ-32(V)2 ESM systems reliability and maintainability characteristics in order to determine their inherent and operational availability and their associated design and logistic support constraints. This report highlights the strengths and weaknesses in the availability of these two systems. From this study it is hoped to establish requirements from which to build the specifications of a third generation ESM system and to foster improvements where appropriate to existing hardware.

Methodology

Operational and support requirements of the AN/WLR-1G, ESM system were reviewed. The reliability and maintainability of the AN/WLR-1G was then evaluated using both 3-M field data and MIL-HDBK 217B Prediction Techniques. The resulting Mean-Time-Between-Failure (MTBF), Mean-Time-to-Repair (MTTR) and Mean-Down-Time (MDT) numbers were used to calculate inherent and operational availability for the system. The AN/SLQ-32(V)2 was evaluated in the same manner.

Findings

Tables A-1, A-2a and A-2b provide the Reliability, Maintainability and Availability (RMA) data for the AN/WLR-1G and the AN/SLQ-32(V)2. Table A-2a provides a summary of predictions developed for the suite 2 of the AN/SLQ-32(V). Table A-2b is a summary of data gathered for the ESM portion of the Prototype and equivalent to suite 2 of the production configuration.

TABLE A-1

RMA RESULTS FOR THE AN/WLR-1G

MTBF (MIL-HDBK 217B Prediction)	106 hours
MTTR (MIL-HDBK 472 Procedure 2 Prediction)	3.35 hours
MDT (3-M Field Data)	72 hours
Inherent Availability	0.97
Operational (Actual Field) Availability	0.58

Inherent availability $\left(\frac{MTBF}{MTBF + MTTR}\right)$ provides a measure of the system design constraints. The operational availability $\left(\frac{MTBF}{MTBF + MDT}\right)$ provides a measure of the available logistics support. The constituent elements of MDT with their respective percent distributions are discussed in section 3.4.1 and are shown below:

Item	Hours	Percent
Repair Time/yr.	171.0	4.7
Logistics Delay Time/yr.	3261.2	90.1
Administrative Time/yr.	51.0	1.4
PMS Time/yr.	137.8	3.8
Total Down Time/yr.	3621.0	100.0

TABLE A-2a

RMA RESULTS FOR THE AN/SLQ-32(V)2

MTBF (MIL-HDBK 217B Prediction)	259 hours
MTTR (MIL-HDBK 472 Procedure 2 Prediction)	1.045 hours
Inherent Availability	0.99
Operational (Projected Field) Availability	See Note 1

1/ This value is discussed and presented in section 4.3.3 in the report.

TABLE A-2b

AN/SLQ-32(V) PROTOTYPE TECHEVAL DATA SUMMARY

ESM Operating Hours	1034 hours
ESM Total Maintenance Actions	8
ESM Maintenance Actions considered major failures	2
ESM Maintenance Actions considered minor failures	3
ESM Maintenance Actions considered preventive maint.	3
ESM Total Major Failure 2/ corrective maintenance time	3.96 hours
ESM Total Minor Failure 3/ corrective maintenance time	5.2 hours
ESM Total Preventive maintenance time	.76 hours
*Observed ESM MTBF	517 hours
*Observed ESM Mean corrective maintenance time	1.98 hours
*Observed ESM inherent availability	0.996

Conclusions

Key failures which impact both MTBF and MTTR of the AN/WLR-1G are as follows:

1. One half of repair actions (22 out of 44) over a 30 month period were associated with the IP-480 display. These took 7.1 hours on an average to repair, or 156.2 hours (Table 3-3).
2. Converter CV-742 is the unit showing the longest repair time: The resultant MTTR was 16.4 hours. Three repair actions were involved causing a 49.2 hour experience (Table 3-3).
3. Tubes accounted for 50% of system failures; variable resistors (RV) accounted for 24% of system failures (68 of the 104 variable resistors are in the IP-480).

Further studies which included the AN/SLQ-32(V)2 system provided additional insight into the availability goals for future ESM systems. Inherent availability goals are

2/ Major Failure - ESM mission accomplishment prevented
3/ Minor Failure - ESM mission accomplishment degraded
* Based on 2 major failures

tabulated below along with indications of the difficulty for attainment:

ESM RMA GOALS

MTBF (hours)	MTTR (hours)	A	LIKELIHOOD OF ACHIEVEMENT
250	1.0	0.996	Modestly Difficult
250	0.5	0.998	Difficult
500	1.0	0.998	Difficult
500	0.5	0.999	Very Difficult

Design efforts to obtain these goals must consider the following:

1. Use of self-test features.
2. Use of standard components based on a low failure rate technology.
3. Implementation of redundancy -
   a. Adoption of techniques (for example: antennas) wherein performance "gracefully" degrades with component failure.
   b. Separation of performance functions into several modes of operation wherein failure of one mode would still permit mission success in some acceptable degraded capability.
4. Quality Assurance and Quality Control during the procurement and development stages.
5. Mechanical design to facilitate access and to minimize environmental effects.

Recommendations

The following studies are proposed based upon conditions discovered during this availability study of the AN/WLR-1G and the AN/SLQ(V)2 ESM systems:

1. Study of CASREPS to determine if supply line constraints are causing unnecessary down time.
2. Study of the CV-3599 replacement for the CV-741 and CV-742 to determine its effect on AN/WLR-1G MTBF.
3. Study of the feasilbility of replacing the IP-480 and Power Supplies (PP 2156D and PP 2157D).

4. Study of the AS-899 Antenna drive train mechanization to determine what may be causing coupling failures.

5. Study of the CV-1162A Tuner regulator to determine what may be causing abnormal high failure rate.

The studies are proposed in the order of priority. This order of studies is recommended as the most effective relative to design and development of ESM. However, it has been indicated that data may be currently available that would minimize the extent of studies 2 and 3.

JL/es

TABLE OF CONTENTS

1.0 INTRODUCTION

This report has been prepared specifically to analyze the AN/WLR-1G and the AN/SLQ-32(V)2 reliability and maintainability characteristics in order to determine their availability indicies along with the associated design and logistic support constraints. By highlighting strong points and weak points in the availability of these two systems it is hoped to establish the requirements from which to build the specifications of a third generation ESM and to foster improvements where appropriate to existing hardware.

2.0 SCOPE

The studies performed in this report were limited to suite 2 of the AN/SLQ-32(V)2 and band 9 operation for the AN/WLR-1G. Specific areas addressed were:

1) Support requirements (Maintenance requirements)
2) Operational Requirements
3) Electrical Design Constraints - functional redundancy
4) Mechanical Design Constraints - maintainability and degree of modularity
5) Fault isolation effectiveness
6) Equipment environmental exposure

The study was based on review of operating and support requirements specified in the applicable Technical Manuals,3-M data on the WLR-1G and technical data gathered on the USS Leahy for the SLQ-32(V) XN-1 prototype model.

3.0 STUDY OF THE AN/WLR-1G

For the purposes of this study only Band 9 operation of the AN/WLR-1G was considered. Both reliability and maintainability evaluations were made on Band 9 from which both inherent and operational availabilities were computed for its various operational modes.

3.1 AN/WLR-1G SYSTEM DESCRIPTION

The AN/WLR-1G receiving set is comprised of a number of units which contain RF tuners, frequency converters, RF switches, power supplies and a pulse analyzer. When coupled with the AS-899/ SLR and other antennas, the AM-1017B Magnetic Control Amplifier, the C-3118 Control Indicator and the AN/WLA-3B Amplifier, a complete ESM receiver system is formed. This is the surveillance system currently being used in the fleet.

The AN/WLR-1G equipment is physically split into three locations when installed aboard ships. The tuners, power supplies and RF switches are, in most ships, installed in an ESM equipment room. The antennas are mast mounted, either forward or aft, depending on the ship's configuration. The frequency converters, pulse analyzers and various control units are located in the operators' area in the CIC. Figure 3-1 presents a pictorial representation of the system components.

3.1.1 OPERATIONAL REQUIREMENTS

Normal Operation of the AN/WLR-1G is through direct control of the equipment by the operator. A minimum of 2 people are required to stand watch on this equipment and four hours is the maximum time an operator would normally be required to stand watch before being relieved. For extended operational periods, 4 or more persons may be required to man the AN/WLR-1G for a given ESM surveillance function.

Initially, the operator sets the equipment for an acquisition function of operation and begins to look for an indication of a signal (or signals) on the display. Upon detecting a signal the operator sets the equipment for the analysis function and determines signal bearing and signal characteristics via the display.

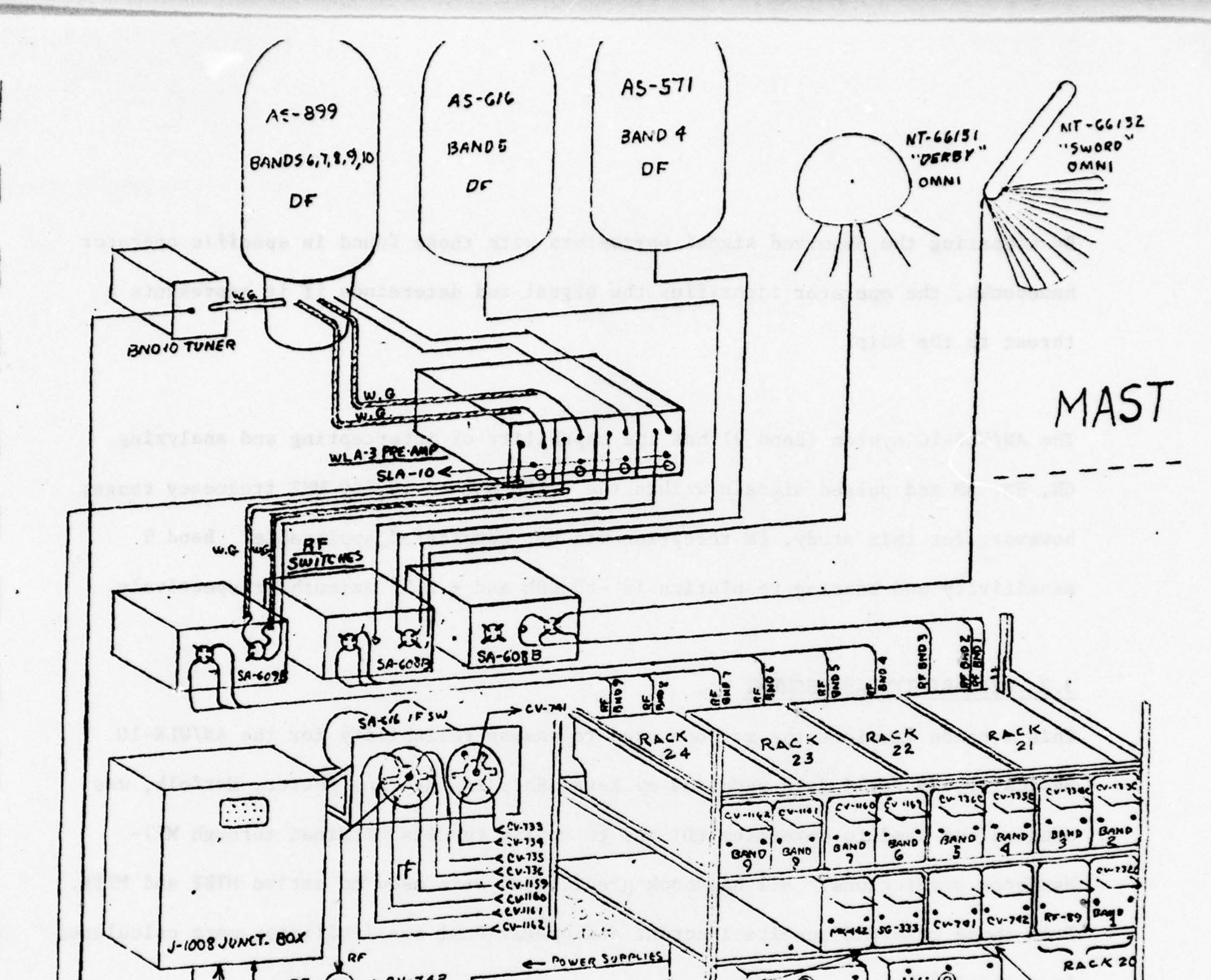


FIGURE 3-1 WLR-1G SYSTEM COMPONENTS

By comparing the observed signal parameters with those found in specific operator handbooks, the operator identifies the signal and determines if it represents a threat to the ship.

The AN/WLR-1G system (Band 9) has the capability of intercepting and analyzing CW, FM, AM and pulsed signals wtihin the 7,300 MHZ to 10,750 MHZ frequency range; however, for this study, FM reception was not considered applicable. Band 9 sensitivity and bearing resolution is -80 DBM and $\pm$ 2.5° azimuth, respectively.

3.2 RELIABILITY ASSESSMENT

This section examines the methods used to assess reliability for the AN/WLR-1G. Basically, 3M field data supplied by Naval Ship Engineering Center, Norfolk, was studied and used to determine MDT and to verify results obtained through Mil-Handbook predictions. Mil-handbook predictions were used to derive MTBF and MTTR. From these combined results inherent and operational availabilities were calculated in section 3.4.

3.2.1 FAILURE ASSESSMENT FROM 3-M FIELD DATA

Table 3-1 gives the summary of information obtained from analyzing 1975 and 1976 field data. Data for 1975 was for the full year while 1976 was for nine months only. Only those actions identifying parts replaced by circuit symbol designation were tabulated. This was done in order to identify failures to specific units. As can be seen from Table 3-1, there was an insufficient quantity of usable entries to determine failure rates for all units since only 20% of the listings (98 out of 470) were identified to the unit level.

The results, therefore, are presented mainly for comparison with the Mil-Handbook predictions of Table 3-2. Appendix A provides a listing of the 3-M data which was used.

TABLE 3-1

3-M FAILURE DATA SUMMARY - AN/WLR-1G

UNIT	DESCRIPTION	1975 FAILURES	1976 FAILURES	TOTAL FAILURES	PERCENT OF TOTAL FAILURES
*CV-732D	Band 1 Tuner	1	4	5	5.10
*CV-733D	Band 2 Tuner			2	2.04
*CV-734D	Band 3 Tuner	4	1	5	5.10
*CV-735D	Band 4 Tuner	2	0	2	2.04
*CV-736D	Band 5 Tuner	1	1	2	2.04
*CV-1159A	Band 6 Tuner	4	0	4	4.08
*CV-1160A	Band 7 Tuner	3	3	6	6.12
*CV-1161A	Band 8 Tuner	0	2	2	2.04
CV-1162A	Band 9 Tuner	1	5	6	6.12
CV-741D	Freq. converter	6	3	9	9.18
CV-742D	Freq. converter	5	1	6	6.12
IP-480	Pulse Analyzer	13	11	24	24.49
C-2697G	Control Storer	2	4	6	6.12
RF-89D	Freq. Discriminator		No Data		
PP-2156D	Power Supply	0	3	3	3.06
PP-2157D	Power Supply	6	2	8	8.16
J-1008C	Interconnect Box	1	1	2	2.04
SA-608C	Antenna Switch		No Data		
SG-333D	Pulse Test Equip.	0	3	3	3.06
SA-609C	Antenna Switch		No Data		
SA-616B	R.F. Switch	2	0	2	2.04
SA-608C	Antenna Switch	0	2	2	2.04
		50	48	98	100%

*Results were not included in band 9 study

3.2.2 FAILURE ASSESSMENT BY MIL HANDBOOK PREDICTION

A reliability prediction was performed according to the procedures of MIL-HDBK-217B. The generic method of Section 3 in 217B was used on the AN/WLR-1G to obtain a preliminary estimate for this study. Mechanical part failure rates were assigned from data found in the RAC document "Nonelectronic Parts Reliability Data" and the "Mechanical Design and Systems Handbook".* Appendix B lists the generic failure data for all electronic and dynamic mechanical parts by units for the AN/WLR-1G and for peripheral equipment. Table 3-2 shows a summary of the total failure rate and MTBF by unit and peripheral equipment designation. These data were used in the availability indices derived in section 3.4.

3.2.3 RELIABILITY BLOCK DIAGRAMS WITH FAILURE ASSESSMENTS

Reliability block diagrams were developed for the three functional modes (DF, acquisition and analysis for band 9 operation) from the functional block diagram in figure 3-2. The reliability block diagrams indicate what is contained in each block and whether equipment operation is in a series or parallel (redundant) function. Figure 3-6 shows the overall combined operation reliability block diagram. Figures 3-3, 3-4 and 3-5 provide the apportioned failure rate reliability block diagrams for the DF mode, acquisition mode and analysis mode, respectively.

Once failure rates are assigned to the blocks shown in the reliability block diagram, the overall mode failure rate and hence, MTBF can be found for a particular mode, by the equation:

---

* See references 5, 6 and 7

$$MTBF_{sys} = \int_0^\infty R(t)dt = \int_0^\infty R_\Sigma(t)dt \cdot R_{5,6}(t)dt \qquad [3\text{-}1]$$

where: $R_\Sigma(t) = e^{-\sum_{i=1}^{n} (\lambda_i)t} = e^{-\lambda_\Sigma t}$ for i = 1, 2, 3, 4, 7 - 14

$$R_{5,6}(t) = e^{-\lambda_5 t} + e^{-\lambda_6 t} - e^{-(\lambda_5 + \lambda_6)t}$$

But, for the series blocks,

$$\int_0^\infty R_\Sigma(t)dt = \int_0^\infty e^{-\lambda_\Sigma t}\, dt = MTBF_\Sigma = \frac{1}{\lambda_\Sigma} \qquad [3\text{-}2]$$

and, the redundant blocks,

$$\int_0^\infty R_{5,6}(t)dt = \int_0^\infty [e^{-\lambda_5 t} + e^{-\lambda_6 t} - e^{-(\lambda_5 + \lambda_6)t}]dt \qquad [3\text{-}3]$$

$$MTBF_{5,6} = \frac{1}{\lambda_5} + \frac{1}{\lambda_6} - \frac{1}{\lambda_5 + \lambda_6} \qquad [3\text{-}4]$$

Then substituting,

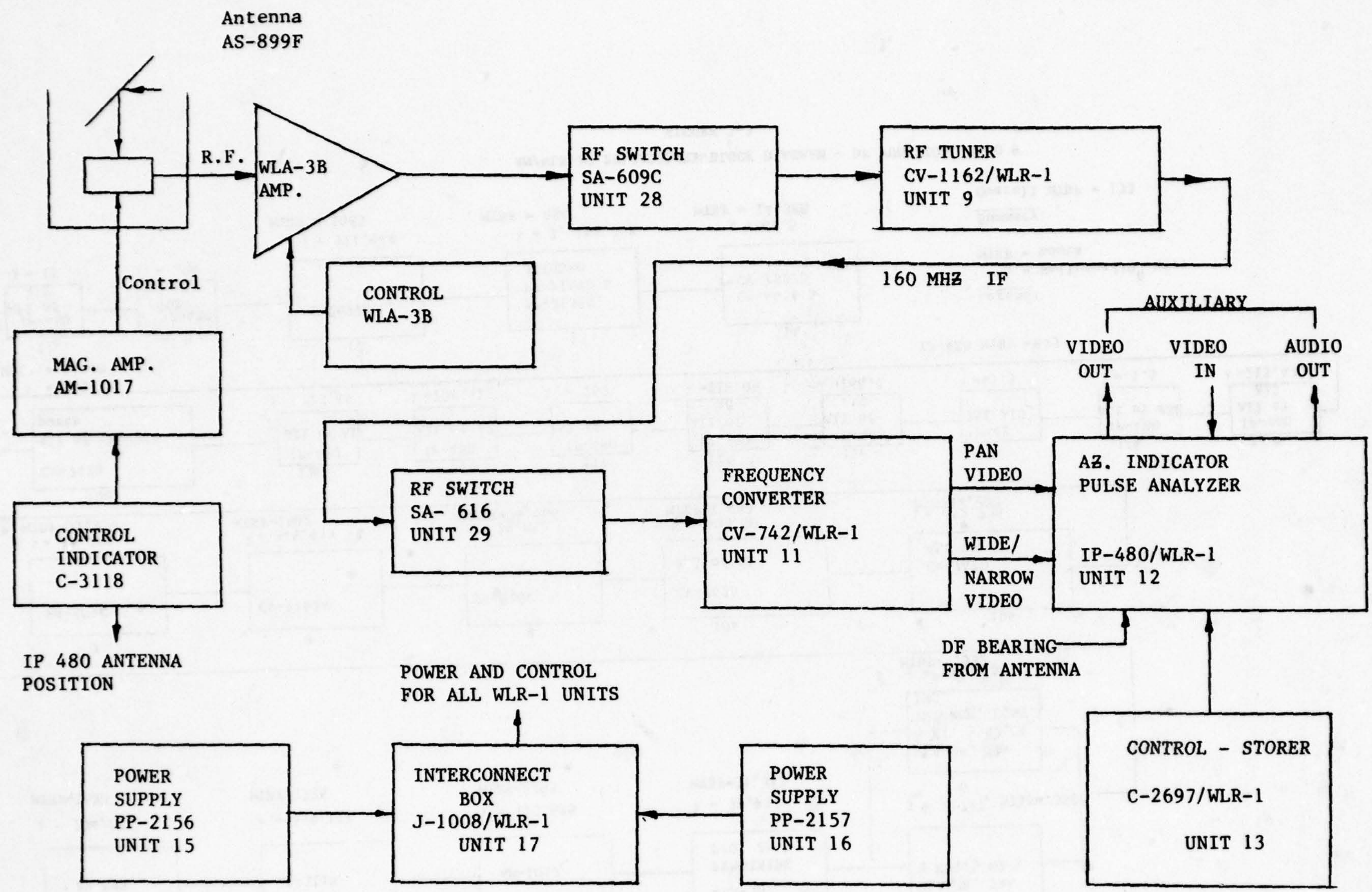
$$MTBF_{sys} = \left(\frac{1}{\lambda_\Sigma}\right)\left(\frac{1}{\lambda_5} + \frac{1}{\lambda_6} + \frac{1}{\lambda_5 + \lambda_6}\right) \qquad [3\text{-}5]$$

Shown below are the resultant MTBF's for the different modes of operation

MODE	MTBF (HOURS)
Acquisition	136
Analysis	118
DF	133
Combined	106

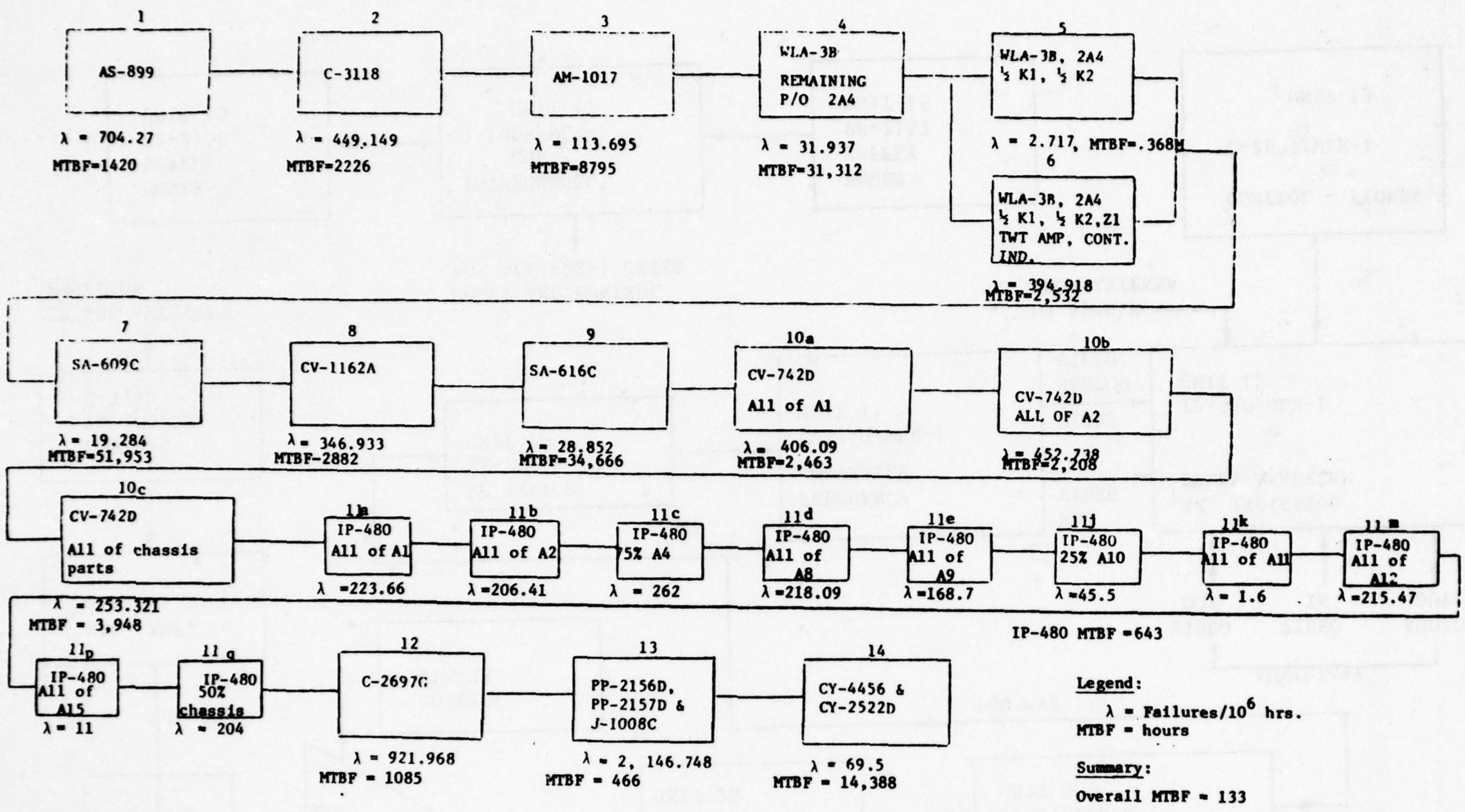
TABLE 3-2
AN/WLR-1G SYSTEM
RELIABILITY PREDICTION SUMMARY

UNIT	DESCRIPTION	$F/10^6$ Hrs.	MTBF (Hrs.)	UNIT	DESCRIPTION	$F/10^6$ Hrs.	MTBF (Hrs.)
CV-732D	Band 1 Tuner	315.544	3,169	SA-616B	R.F. Switch	7.200	138,889
CV-73D	Band 2 Tuner	312.395	3,210	SA-608C	Antenna Switch	23.730	42,141
CV-734D	Band 3 Tuner	314.895	3,176	--	Rack 20	26.640	37,537
CV-735D	Band 4 Tuner	131.429	3,191	--	Rack 21	22.240	44,964
CV-736D	Band 5 Tuner	708.209	1,412	--	Rack 22	24,880	40,193
CV-1159A	Band 6 Tuner	366.540	2,728	--	Rack 23	24.372	41,031
CV-1160A	Band 7 Tuner	370.540	2,699	--	Rack 24	25.252	39,601
CV-1161A	Band 8 Tuner	346.133	2,889	--	Rack 25	44.276	22,586
CV-1162A	Band 9 Tuner	346.933	2,882	AS-899F	Antenna	704.27	1,420
CV-741D	Freq. converter	988.927	1,011	AM-1017B	Mag. Amp.	113.695	8,795
CV-742D	Freq. converter	1,112,149	899	C-3118	Ant. Control	449.149	2,226
IP-480	Pulse Analyzer	3,490.58	286	AN/WLA-3B	Amplifier	454.950	2,198
C-2697G	Control Storer	921.968	1,085				
RF-89D	Freq. Discriminator	993.823	1,006				
PP-2156D	Power Supply	794.339	1,259				
PP-2157D	Power Supply	1,343.355	744				
J-1008C	Interconnect Box	54.054	18,500				
SA-608C	Antenna Switch	22.230	44,984				
SA-609C	Antenna Switch	19.284	51,856				



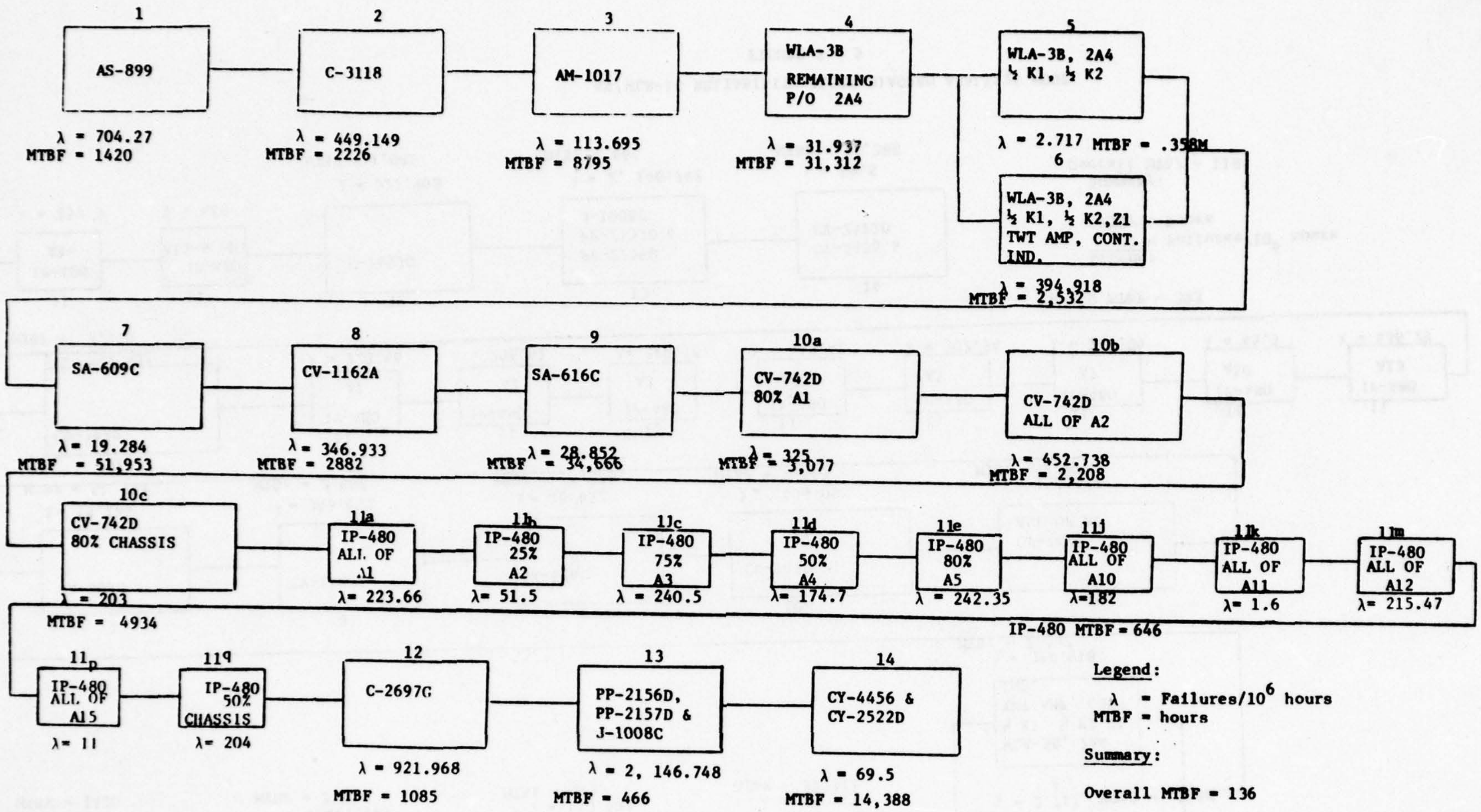
AN/WLR-1G FUNCTIONAL BLOCK DIAGRAM - BAND 9 TUNING

FIGURE 3-2



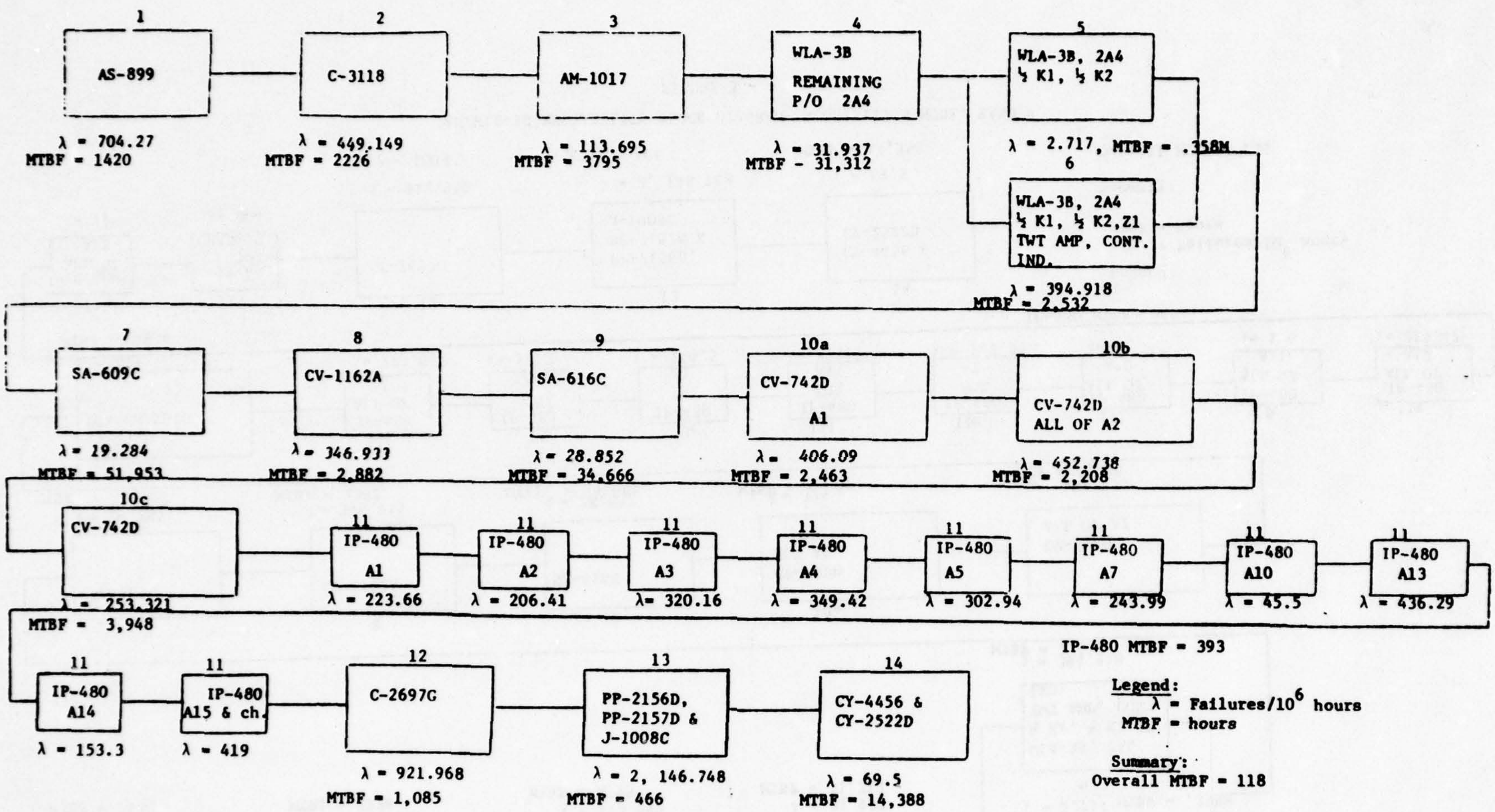
AN/WLR-1G RELIABILITY BLOCK DIAGRAM - DF FUNCTION, BAND 9

FIGURE 3-3



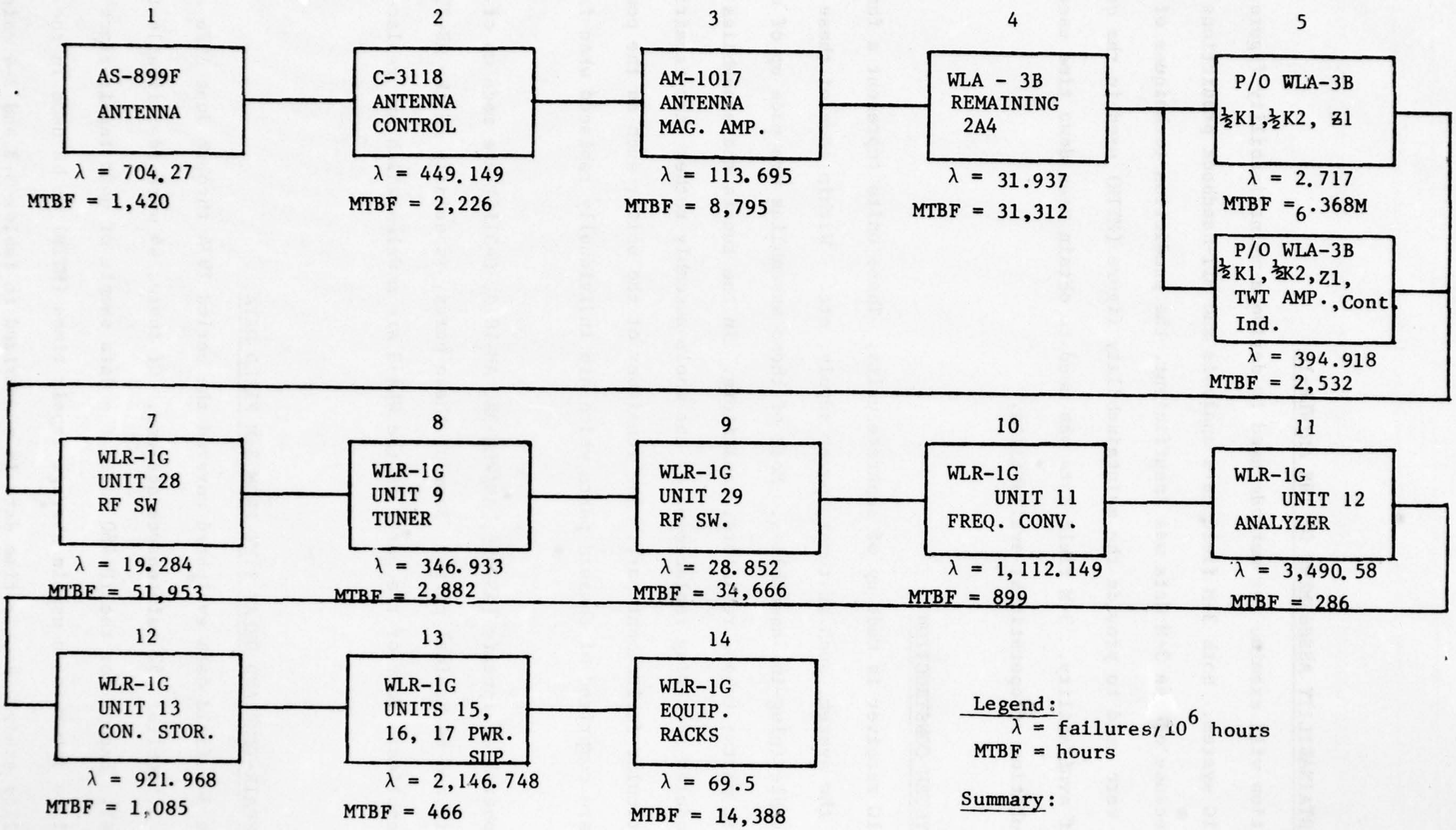
AN/WLR-IG RELIABILITY BLOCK DIAGRAM- ACQUISITION MODE, BAND 9

FIGURE 3 - 4



AN/WLR-1G RELIABILITY BLOCK DIAGRAM ANALYSIS MODE

FIGURE 3 - 5



Legend:
λ = failures/10^6 hours
MTBF = hours

Summary:
Overall MTBF = 106

AN/WLR-1G RELIABILITY BLOCK DIAGRAM - BAND 9, COMBINED MODES

FIGURE 3 - 6

3.3 MAINTAINABILITY ASSESSMENT OF THE AN/WLR-1G

This section will examine the methods used to derive a maintainability figure for the WLR-1G system. Both 3-M field data analysis and Mil-Handbook predictions were used. Because of the 3-M data was insufficient, the prediction techniques of MIL-HDBK-472 were used to provide the maintainability figure (MTTR) used in the calculation of availability. 3-M field data was used to obtain mean down time used in the calculation of operational availability.

3.3.1 SYSTEM CONSTRUCTION

The WLR-1G receiver is made up of separate units. These units represent a functional block of the system, such as tuner, power supply, etc. Within some of these units are removable (plug-in) assemblies. Most of these assemblies are made up of discrete electronic parts; tubes, resistors, capacitors. In the tuners the assemblies are sealed modules requiring replacement of the whole assembly rather than repairing it by a particular replacement part. The remainder of the units, such as the power supply, are comprised of chassis parts which are individually replaced when faulty.

The peripheral equipments (AS-899, AN/WLA-3B, AM-1017, C-3118) are made up of electronic and mechanical parts. Some of these parts, especially in the AS-899, form assemblies. Most of the parts in the WLA-3 are modules which are replaced intact.

3.3.2 REPAIR-TIME AND DELAY TIME FROM 3-M FIELD DATA

The first 3-M field data evaluated covered the period 1974 through June 1976 and included a total of 352 maintenance actions. Of these, 44 were identifiable to the unit level. Except for the IP-480 unit, the data sample of unit repair-times was too small to determine a usable average repair times (MTTR) to be used in the band 9 availability study. Repair-time data is summarized in tables 3-3 and 3-4 mainly for

TABLE 3-3

AN/WLR-1G UNIT LEVEL REPAIR TIME
3-M DATA 1974 THROUGH JUNE 1976

UNIT NAME	NUMBER OF REPAIR ACTIONS	AVERAGE REPAIR TIME* (Man-Hrs) / (No. Repair Actions x 1.5)
RF Tuner, CV1162	5	5.3
RF Switch, SA-609C	1	2.7
RF Switch, SA-b16C	1	13.3
Converter, CV-742	3	16.4
Azimuth Ind., IP 480	22	7.1
Control Storer	4	5.5
Power Supply, PP2156	3	10.2
Power Supply, PP2157	4	13.5
Interconnect, J-1008	1	2

*The Naval Ship Engineering Center,Norfolk determined that on the average , 1.5 men are used for each repair task. Therefore, man-hours are divided by 1.5 to determine repair time.

TABLE 3-4

IP 480 ASSEMBLY LEVEL REPAIR TIMES
3-M DATA 1974 THROUGH JUNE 1976

	Assembly Name	Number of Repair Actions	Avg. Repair Time* Man-Hrs
			No. Actions x 1.5
A1	Video AMP	4	2.3
A2	Panoramic AMP	1	1.3
A3	0-5 M Sec Sweep	1	1.3
A4	Pulse Stretcher	1	40
A5	5-500 M sec Sweep	none listed	-
A6	Not Used	none listed	-
A7	.5-50k M Sec Sweep	none listed	-
A8	Horiz-Vert AMP	none listed	-
A9	DF PRE-AMP	none listed	-
A10	Scan Video	none listed	-
A11	DF/Scan Selector	none listed	-
A12	Scan Deflection	3	2
A13	Freq. Ind.	6	10.8
A14	Ind. Servo AMP	none listed	-
A15	Equipment Cabinet	1	20
	Chassis	4	2.6
	Not Identificable	1	4.0
	Total	22	

*The Naval Ship Engineering Center has determined that on the average, 1.5 men are used for each repair task.

study and comparison with Mil-Handbook predictions in section 3.3.3. Appendix C contains the 3-M Field Data analysis sheets.

A second set of 3-M field data covering the period January through June 1978 was also evaluated. It included the 185 maintenance actions plotted in figure 3-7. The plot shows an exponential distribution of repair times. An exponential distribution of repair-time is typically found for equipments which have relatively low repair-times i.e. most repairs are accomplished within a short time. For the AN/WLR-1G receiver, a low repair-time would be expected considering that plug-in tubes are the most frequent repair time. (These results correlate with the results obtained in the next section from Mil-Handbook predictions.)

Examination of the field data showed that the AN/WLR-1G receiver inherently requires a high number of relatively short repairs. In addition, the IP-480, which requires the most frequent repairs, was usually repaired within the .6 to 3 hour time span. The less frequent repair-times had long durations indicating that repair-times reported may include administrative or logistics delay time. (Sample size for the AS-899 and AN/WLA-3B was too small for individual analysis)

Delay time was tabulated from the above sets of 3-M field data and shown in Table 3-5.

TABLE 3 - 5

ESTIMATED DELAY TIMES FOR AN/WLR-1G

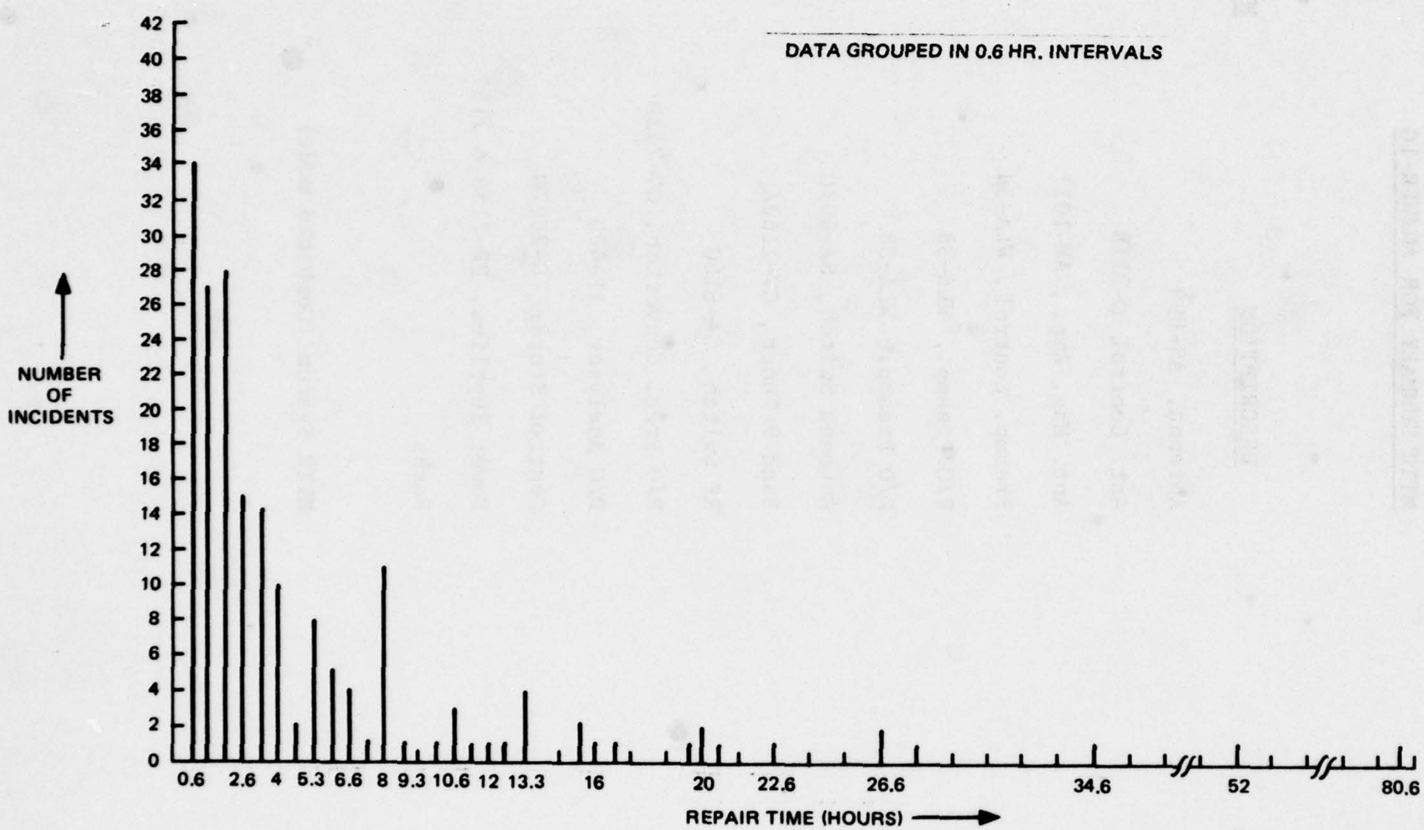
EQUIPMENT	ESTIMATED DELAY TIME (hcurs)
WLR-1G Receiver	49
899 Antenna	79
WLA-3B Amplifier	89
C-3118 Control	79
AM 1017B Mag Amp	95

These data were used to obtain mean down time for the operational availability calculations in Tables 3-7 through 3-10 by adding the respective equipment delay time to the associated MTTR (MDT = MTTR + Delay Time).

3.3.3 REPAIR-TIME EVALUATION BY MIL-HANDBOOK PREDICTION

Since repair-times could not be adequately determined from the 3-M field data, a maintainability prediction using procedure II of MIL-HDBK-472 was performed to assess an MTTR figure (see Table 3-6). Detailed time estimates and procedures are summarized in Appendix C.

Examination of Table 3-6 shows relatively long repair times associated with the antenna, the antenna control and the Preamp. Both the antenna and the WLA-3B Preamp are mast mounted and, therefore, difficult to access for maintenance.



WLR-1G REPAIR INCIDENTS VS. REPAIR TIME (LINEAR SCALE)

FIGURE 3-7

TABLE 3 - 6

MTTR SUMMARY FOR AN/WLR-1G

BLOCK	DESCRIPTION	MTTR (HRS.)
1	Antenna, AS-899	6.0
2	Ant. Control, C-3118	5.1
3	Ant. Mag. Amp., AM-1017	5.1
4	Preamp. Control, WLA-3B	5.0
5	P/O Preamp., WLA-3B	5.0
6	P/O Preamp., WLA-3B	5.0
7	Antenna Switch, SA-609C	2.2
8	Band 9 Tuner, CV-1162A	2.35
9	RF Switch, SA-616C	2.48
10	P/O Freq. Converter, CV-742D	4.79
11	P/O Analyzer, IP-480	3.16
12	Control Storer, C-2697G	3.2
13	Power Supplies, PP-2156 & 2157	2.3
14	Racks	2.3
	MTTR System (Combined mode) =	3.35 hours

The Control Indicator C-3118 has micro switches, synchros and resolver which have long interchange and alignment times. These components contribute heavily to the C-3118 overall high repair time - in the order of 1.5 to 2 hours of the 5.1 hour MTTR.

The Mag Amp AM 1017 has a high repair-time primarily because of difficulty in isolating faults and performing alignment. Coordination effort is required to ensure proper antenna rotation. In addition, by nature the magnetic amplifier,circuits are difficult to troubleshoot because proper understanding of its operation is difficult for most technicians. Some of its components are also difficult to access because of equipment construction.

The CV-742D Converter has a high repair-time because of lengthy alignment procedures. Alignment along contributes about 3 hours of the 4.79 MTTR.

3.4 AVAILABILITY INDICES FOR THE AN/WLR-1G

Both Inherent and Operational Availability indices were determined for the AN/WLR-1 The results are presented in tables 3-7 through 3-10 for the several operational modes of the system. Inherent availability is defined as the probability that at any point in time the system will perform th^ specified function(s) for a successful mission. All support requirements are fully available. Redundancy is considered applicable and delay times are not existent. Operational Availability is defined as the probability that at any point in time the system is fully operational to perform in the particular mode of interest. Redundancy, therefore, would not be considered and all delay times are considered as part of total down time. The Inherent and Operational Availability math models used in these calculations are given in Appendix D.

TABLE 3 - 7

AN/WLR-1G DF MODE AVAILABILITY

REL BLOCK	DESCRIPTION	($F/10^6$ HRS.)	REPAIR TIME (HRS.)	DOWNTIME (HRS.)
1	AS-899 ANTENNA	704.27	6.0	85.0
2	C-3118 ANT. CONTROL	449.149	5.1	84.1
3	AM-1017 ANT. MAG. AMP.	113.695	5.1	100.1
4	WLA-3B PRE AMP. CONT.	31.937	5.7	94.7
5	WLA-3B RELAYS	2.717*	5.0	94.0
6	WLA-3B TWT	394.918*	5.0	94.0
7	SA-609C ANT. SW.	19.284	2.2	51.2
8	CV-1162A TUNER	346.933	2.35	51.35
9	SA-616C RF SW.	28.852	2.48	51.48
10	CV-742D FREQ. CONV.	1112.149	4.79	53.79
11	IP-480 ANALYZER	1554.43	3.16	52.16
12	C-2697G CONT. STORER	921.968	3.2	52.2
13	PWR. SUPPLIES & J-BOX	2146.748	2.3	51.3
14	RACKS	69.5	2.3	51.3

PARAMETER	TIME PERIOD				
	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	0.97390604	0.97390361	0.97389930	0.97389607	0.97389407
OPERATIONAL AVAILABILITY	---	---	---	---	0.63970306

*Redundant Path

TABLE 3 - 8

AN/WLR-1G ACQUISITION MODE AVAILABILITY

REL BLOCK	DESCRIPTION	($F/10^6$ HRS.)	REPAIR TIME (HRS.)	DOWNTIME (HRS.)
1	AS-899 ANTENNA	704.27	6.0	85.0
2	C-3118 ANT. CONTROL	449.149	5.1	84.1
3	AM-1017 ANT. MAG. AMP.	113.695	5.1	100.1
4	WLA-3B PRE AMP. CONT.	31.937	5.7	94.7
5	WLA-3B RELAYS	2.717*	5.0	94.0
6	WLA-3B TWT	394.918*	5.0	94.0
7	SA-609C ANT. SW.	19.284	2.2	51.2
8	CV-1162A TUNER	346.933	2.35	51.35
9	SA-616C RF SW.	28.852	2.48	51.48
10	CV-742D FREQ. CONV.	980.738	4.79	53.79
11	IP-480 ANALYZER	1546.0	3.16	52.16
12	C-2697G CONT. STORER	921.968	3.2	52.2
13	PWR. SUPPLIES & J-BOX	2146.748	2.3	51.3
14	RACKS	69.5	2.3	51.3

PARAMETER	TIME PERIOD				
	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	0.97454204	0.9745396	0.97453530	0.97453206	0.97453006
OPERATIONAL AVAILABILITY	---	---	---	---	0.64426031

*Redundant Path

TABLE 3 - 9

AN/WLR-1G ANALYSIS MODE AVAILABILITY

REL BLOCK	DESCRIPTION	λ (F/10^6 HRS.)	REPAIR TIME (HRS.)	DOWNTIME (HRS.)
1	AS-899 ANTENNA	704.27	6.0	85.0
2	C-3118 ANT. CONTROL	449.149	5.1	84.1
3	AM-1017 ANT. MAG. AMP.	113.695	5.1	100.1
4	WLA-3B PRE AMP. CONT.	31.937	5.7	94.7
5	WLA-3B RELAYS	2.717*	5.0	94.0
6	WLA-3B TWT	394.918*	5.0	94.0
7	SA-609C ANT. SW.	19.284	2.2	51.2
8	CV-1162A TUNER	346.933	2.35	51.35
9	SA-616C RF SW.	28.852	2.48	51.48
10	CV-742D FREQ. CONV.	1112.149	4.79	53.79
11	IP-480 ANALYZER	2546.67	3.16	52.16
12	C-2697G CONT. STORER	921.968	3.2	52.2
13	PWR. SUPPLIES & J-BOX	2146.748	2.3	51.3
14	RACKS	69.5	2.3	51.3

PARAMETER	TIME PERIOD				
	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	0.97087675	0.970874334	0.97087004	0.97086682	0.97086482
OPERATIONAL AVAILABILITY	---	---	---	---	0.61047726

*Redundant Path

TABLE 3 - 10

AN/WLR-1G COMBINED MODE AVAILABILITY

REL BLOCK	DESCRIPTION	$(F/10^6$ HRS.)	REPAIR TIME (HRS.)	DOWNTIME (HRS.)
1	AS-899 ANTENNA	704.27	6.0	85.0
2	C-3118 ANT. CONTROL	449.149	5.1	84.1
3	AM-1017 ANT. MAG. AMP.	113.695	5.1	100.1
4	WLA-3B PRE AMP. CONT.	31.937	5.7	94.7
5	WLA-3B RELAYS	2.717*	5.0	94.0
6	WLA-3B TWT	394.918*	5.0	94.0
7	SA-609C ANT. SW.	19.284	2.2	51.2
8	CV-1162A TUNER	346.933	2.35	51.35
9	SA-616C RF SW.	28.852	2.48	51.48
10	CV-742D FREQ. CONV.	1112.149	4.79	53.79
11	IP-480 ANALYZER	3490.58	3.16	52.16
12	C-2697G CONT. STORER	921.968	3.2	52.2
13	PWR. SUPPLIES & J-BOX	2146.748	2.3	51.3
14	RACKS	69.5	2.3	51.3

PARAMETER	TIME PERIOD				
	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	0.96801246	0.96801005	0.96800576	0.96800255	0.96800057
OPERATIONAL AVAILABILITY	---	---	---	---	0.58505027

*Redundant Path

3.4.1 DISCUSSION OF AN/WLR-1G RESULTS

As seen from the Tables, the inherent availability remains nearly constant over the selected time periods. The slight change that occurs in the numerical value of availability is due to the slightly increasing probability of failure of the redundant path as the time period increases. The small change in availability indicates that the redundant path failures have a small effect on overall inherent availability.

The operational availability figures shown in the tables are probably representative of day to day activity over the 1 year period -- that is, the time expended in keeping the equipment at optimum conditions. To assess the impact of down time on operational availability, the contribution of the several elements of down time may be evaluated. Administrative time may be mathematically estimated from known distribution of repair time*. Such an estimate for this system would range from 0.5 to 1 hour. PMS time is found to be 137.8 hours from the PMS Table in Appendix C by adding the appropriate maintenance times over a 1 year period. The MTBF for the system is found to be 101.7 hours by summing all failure rates shown in Table 3-10 . The MDT is found to be 72 hours by finding the average of the failure-rate-weighted Delay Times in Table 3- 10. The resultant one year down time is:

MDT = 72 hours.

Number of failures per year = (24 hours)(365)/(MTBF + MDT) = 51

$\text{Down Time}_{yr.} = \text{Repair Time}_{yr.} + \text{Logistics Delay}_{yr.} + (1.0)(51) + 137.8$

From the above equation, $\text{Logistics Delay}_{yr.}$ is derived to be 3261.2 hours. The constituent elements of MDT with their respective percent distributions were

*Administrative time may be estimated by assuming a Weibull distribution function and proportional to repair time. Reference: Reliability Engineering, Arinc Research Corp., New Jersey, Prentice-Hall, 1968.

determined and are tabulated below:

ITEM	HOURS	PERCENT
Repair Time/yr.	171	4.7
Logistics Delay Time/yr.	3261.2	90
Administrative Time/yr.	51	1.4
PMS 1 yr.	137.8	3.8
Total Down Time	3621	100

3.5 HIGH FAILURE COMPONENTS IN THE AN/WLR-1G

Key failures which impact both MTTR and MTBF are as follows:

1. One half of repair actions (22 out of 44) over a 30 month period were associated with the IP-480 display. These took 7.1 hours on average to repair, or 156.2 hours (Table 3-3)
2. Converter CV-742 is the unit showing the longest repair time. This is 16.4 hours MTTR. Three repair actions were involved causing a 49.2 hour experience (Table 3-3).
3. Tubes account for 50% of system failures RV resistors account for 24% of system failures (Of 104 variable resistors, 68 are in the IP-480)

These data are derived from both the 3-M field data and predictions based on Mil-Handbook 217B. Table 3-11 provides a comparison of the distribution of failures based on field data and Mil-Handbook analysis. Although the actual numerical values differ, the proportions seem to track quite well for most of the units. The greatest disparity is found in the failures for the band 9 tuner. The field failures found were mostly in the regulator subassembly. A more in-depth study of the regulator problem is currently under study by Naval Ship Engineering Center, Norfolk - the cognizant field activity for the AN/WLR-1G.

TABLE 3-11

AN/WLR-1G FIELD DATA vs PREDICTED FAILURE RATE

UNIT	DESCRIPTION	% OF TOTAL SYSTEM FAILRUE RATE FIELD DATA	ANALYTICAL
* CV-732D	Tuner	5.10	2.37
* CV-733D	Tuner	2.04	2.35
* CV-734D	Tuner	5.10	2.37
* CV-735D	Tuner	2.04	2.36
* CV-736D	Tuner	2.04	5.32
* CV-1159A	Tuner	4.08	2.76
* CV-1160A	Tuner	6.12	2.79
* CV-1161A	Tuner	2.04	2.60
CV-1162A	Tuner	6.12	2.61
CV-741D	Freq. Converter	9.18	7.43
CV-742D	Freq. Converter	6.12	8.36
IP-480	Pulse Analyzer	24.49	26.24
C-2697G	Control Storer	6.12	6.93
RF-89D	Freq. Discriminator	0	7.47
PP-2156D	Power Supply	3.06	5.97
PP-2157D	Power Supply	8.16	10.10
J-1008C	InterconnectBox	2.04	0.41
SA-608C	Ant. Switch	0	0.17
* SG-333D	Pulse Generator	3.06 (test equip.)	-
Rack 20	Elect. Cabinet	0	0.20
Rack 21	Elect. Cabinet	0	0.17
Rack 22	Elect. Cabinet	0	0.19
Rack 23	Elect. Cabinet	0	0.18
Rack 24	Elect. Cabinet	0	0.19
Rack 25	Elect. Cabinet	0	0.33
Rack 26	Elect. Cabinet	0	-
SA-609C	Ant. Switch	0	0.14
SA-616C	R.F. Switch	2.04	0.05
SA-608C	Ant. Switch	2.04	0.18
		100.0	100.0

*Not pertinent to the current study.

A review of the 3-M Reports for the AS-899 antenna showed an MTBF of 704 hours versus 1420 derived by the handbook prediction method. The 3-M Reports used, covered a 2 1/2 year period from 1976 through June 1978 and was applicable only to the AS-899 E and F configuration.

The data on the antenna were investigated to attempt to determine if the fiber/metal gears used in the drive train experienced a higher failure rate than estimated. The data did not show the gears to be a troublesome area but rather the couplings. Further investigation revealed that this indication is supported by opinion of personnel involved in maintenance of this equipment,* and coupling failure was attributed to erroneous installation during repair. The metal couplings are used to connect the removable sections of the drive train such as synchro and motor shafts to the main drive. Here again a more in-depth study of the coupling mechanization may be required to determine the nature of the problem.

*Personnel at Navelex Supply, San Diego, were asked about gear failure experience and revealed instead that couplings failed often due to erroneous installation.

4.0 STUDY OF THE AN/SLQ-32(V)2

The SLQ-32(V)2 at this time is in the early operational evaluation phase. Evaluation of the first article production model of each suite will be starting very shortly, therefore, its evaluation for purposes of this report relies very heavily on information gained from other engineering analyses and the Technical Manuals.

4.1 SYSTEM DESCRIPTION

The SLQ-32(V)2 is a passive ESM system providing automatic threat acquisition identification and display. Figure 4-1 provides a functional block diagram of the system. Figure 4-2 provides an overall functional descriptive block diagram. A thorough and detailed functional description is found in reference 1; however, for background purposes of this report, some description significant to this report is reiterated here.

Signals are received via a fixed antenna array system. The antenna system is divided into four multibeam antenna arrays and two semi-omnidirectional antennas to cover bands 2 and 3. Four spiral antennas are used for band 1. The multi-beam arrays provide direction finding redundancy and graceful degradation as discussed in Section 4.2.2. Frequency information is processed through omni antennas and the IFM sections (1A1 and 1A2) and fed to the computer for digital processing. Amplitude and angle information is correlated in the Angle Encoder and fed into the computer for digital processing. The digital subsystem, consisting of 1A4, 1A5, 1A6 and 2A5 provides the automatic threat identification processing for storage and display to the operator.

Although the Technical Manual does not describe separate modes of operation for the AN/SLQ-32(V)2, it may be separated into three functional schematic loops. The three

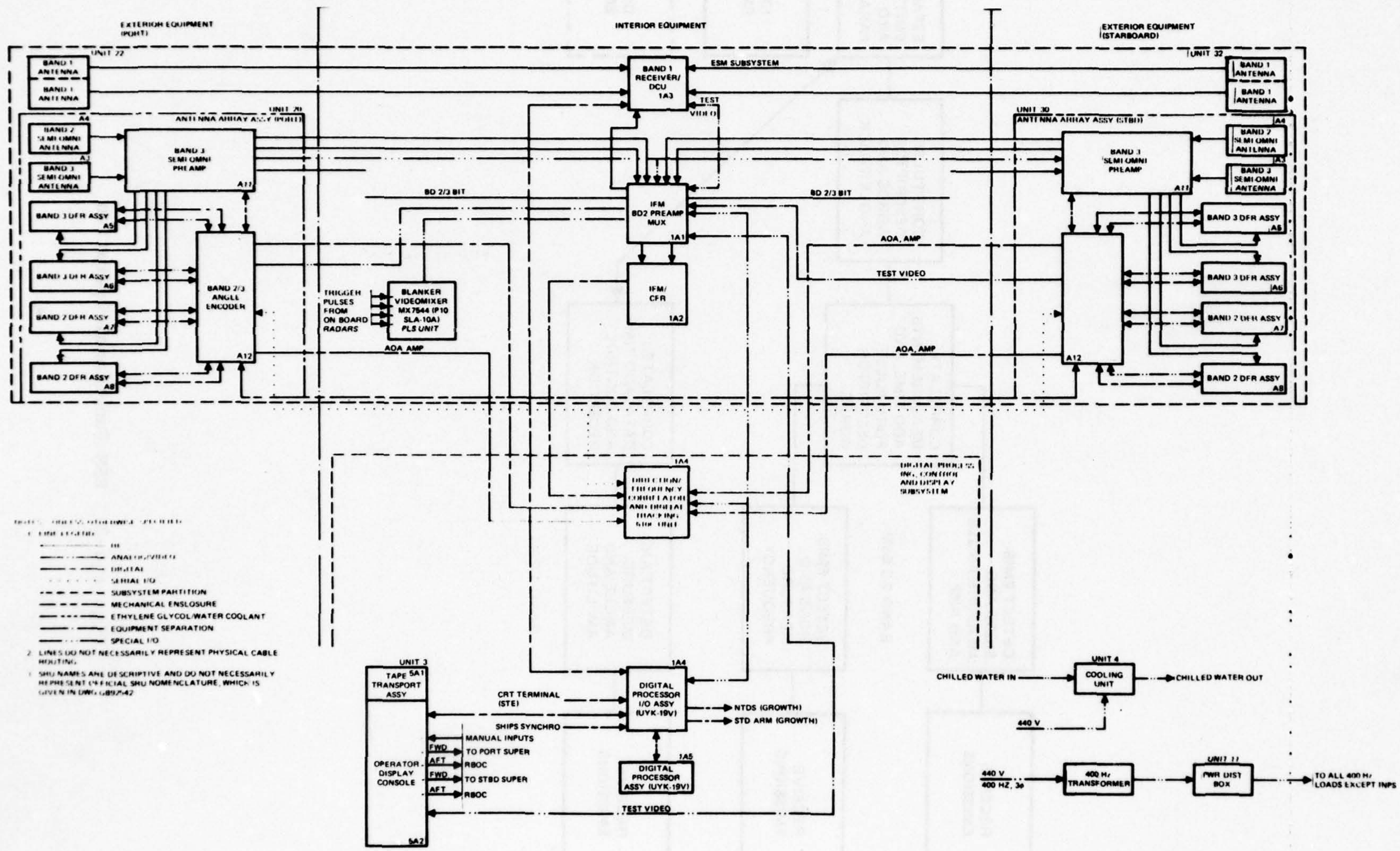


Figure 4-1. Functional Block Diagram of AN/SLQ-32(V)2

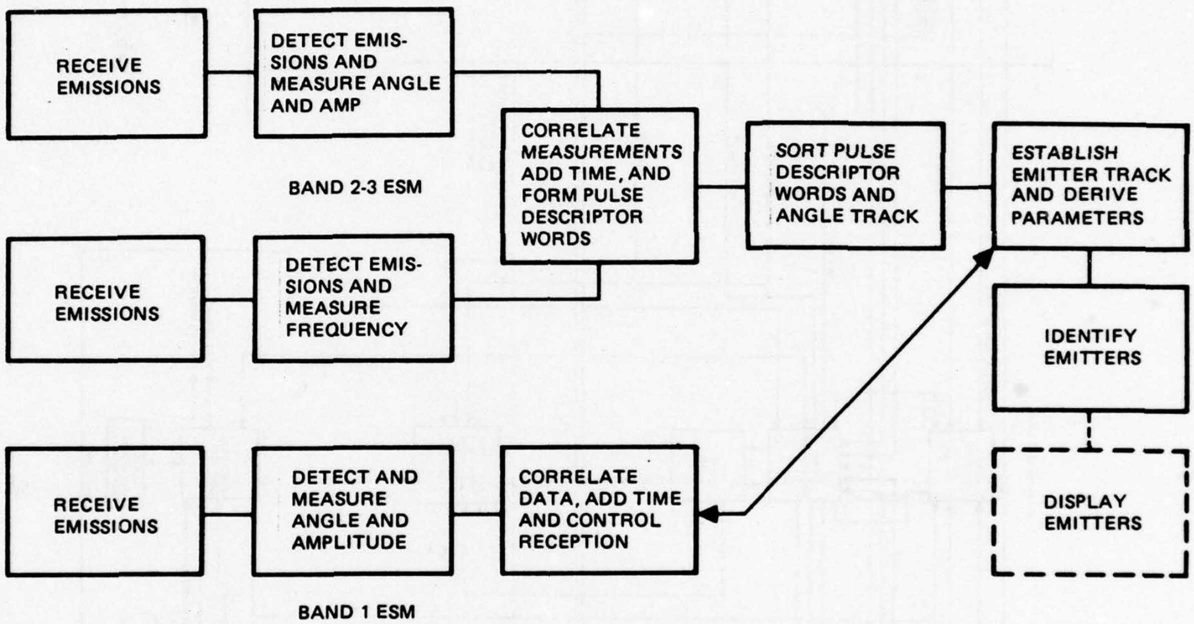


Figure 4-2. ESM Functional Operation

loops are DF, Frequency Measurement and Band 1 Reception. In this report, the loops will be designated as the DF Mode, Frequency Measurement (Acquisition) Mode and Band 1 Reception Mode. DF Mode results in the determination of threat bearing of emitters in bands 2 and 3. The Frequency Measurement (Acquisition) Mode results in the determination of the frequency and pulse parameters of band 2 and 3 emitters. Band 1 Reception Mode detects, determines bearing and provides analysis of emitters in band 1.

4.1.1 OPERATIONAL REQUIREMENTS

Operation of the system requires a three shift watch by operators trained to perform unscheduled maintenance. Much of the system operation is conducted automatically using the software program stored in the computer. The operator's function is to start or stop operation, load the computer program when needed, evaluate the tactical situation and to enter data into or give commands to the system via the computer. The computer provides "prompting" when data is needed from the operator. The operator may enter direct commands into the computer to override certain automatic functions when required. The system controls, indicators, and monitor are located on the Display Console (5A2, figure 4-1). The detailed function of each control and indicator is provided in reference 1 (Technical Manual).

System design is based on a modularity concept. It is intended to have organizational support by replacement of Ship Replaceable Assemblies (SRA) such as printed circuit cards, RF modules and power supply assemblies. Repairable SRA's will be returned to the depot for repair. A minimum of intermediate repair will be performed on-board ship and limited to replacement of connectors, repairing broken wires, solder connections and similar corrective maintenance. Although support is currently being handled by the contractor, the deployment stage support is to be determined by the Navy at a later date. This study assumes the Navy will support the deployment

stage. Appendix B of reference 2 includes a listing of units, assemblies and piece parts. Suite 2 includes approximately 430 SRA's.

4.2 RELIABILITY ASSESSMENT

The AN/SLQ-32(V) is currently going into evaluation of the first-article production model. Field data of the production configuration is non-existent and a limited amount of data is available on the prototype model. This reliability evaluation, therefore, is heavily dependent upon earlier engineering analyses.

4.2.1 FAILURE ASSESSMENT FROM FIELD DATA

The prototype AN/SLQ-32(V) equivalent to suite 3, compiled 1034 operating hours of TECHEVAL operation (reference 3) on board the USS Leahy. Some additional operation was gained on board the USS Virginia, however, results of that evaluation were not available in time for this report. Operation on board the Leahy reported eight maintenance actions against the ESM portion of the system. Of these 8, two were reported as failures which would have resulted in loss of mission performance capability yielding an observed MTBF of 517 hours. Table 4-1 provides a summary of the results. Because of the short duration of evaluation and only two failures, the observed MTBF was not considered applicable for this study. Moreover, the failures are probably representative of early life failures rather than random failures.

One significant observation resulting from Techeval is that there were no reported incidents of computer memory alteration. Memory retention capability provides added confidence to overall computer reliability (including computer power control logic) since memory alteration would be one of the most probable failure modes of the computer or its power source.

TABLE 4-1

AN/SLQ-32(V) PROTOTYPE TECHEVAL DATA SUMMARY

ESM Operating Hours	1034 hours
ESM Total Maintenance Actions	8
ESM Maintenance Actions considered major failures	2
ESM Maintenance Actions considered minor failures	3
ESM Maintenance Actions considered preventive maint.	3
ESM Total Major Failure corrective maintenance time	3.96 hours
ESM Total Minor Failure corrective maintenance time	5.2 hours
ESM Total Preventive Maintenance time	.76 hours
*Observed ESM MTBF	517 hours
*Observed ESM Mean corrective maintenance time	1.98 hours
*Observed ESM inherent availability	0.996

*Based on 2 major failures which prevented ESM mission accomplishment.

4.2.2 FAILURE ASSESSMENT BY MIL HANDBOOK PREDICTION

A reliability prediction has already been prepared by the contractor for the AN/SLQ-32(V). Because of its voluminous size, the complete prediction is not included in this report, but is summarized for ease of reference. The complete prediction is contained in Appendix C of reference 4. The method used to determine part failure rates was according to section 2 of MIL-HDBK-217B, Part Stress Analysis Prediction. Table 4-2 provides the summary of failure rates applicable to each functional block of the AN/SLQ-32(V)2. The portion of the system comprising each block is also identified. All blocks have a duty cycle of 1.0 except for the tape transport unit in block K. It has been assessed that this unit is used 10% of the time.

The assumptions and conditions used in determining reliability for this study were:

(a) The ESM system is required to operate 100% of the mission time.

(b) Mission success is defined to be threat location and identification within the system specifications given in Specification ELEX-C-243C, paragraph 3.2.1 and Table III.

(c) The system is capable of performing a successful mission under the graceful degradation specified in ELEX-C-243C, paragraph 4.5.3.1 and listed here in Table 4-3.

Figures 4-3, 4-4, 4-5 and 4-6 are the reliability block diagrams for the AN/SLQ-32(V)2 ESM system. As seen in figure 4-3, system redundancy is provided in blocks A through D for the DF Mode of Operation. (Redundant elements are indicated by the lower case letters). The numbers in the brackets at the bottom of the blocks indicate the degree of graceful degradation. For block A there are a total of 38 A_i elements and any combination of 35 or more elements operating (with three or less in a failed state) will provide operation with some degradation. Thus, 35 out of 38 are required for mission success even though some degradation of performance occurs, reference table 4-3.

Table 4-2 Reliability Model Block Identification and Failure Rate Summary

BLOCK	CONTENTS OF BLOCK	ITEM PART NUMBER	λ (FAILURES/10^6 HOURS)
A	BAND 2 BEAM FORMING ELEMENT		
	(1) Antenna array element	Part of 927418-1	0.595
	(2) Input port of beam forming lens	Part of 927419-1	0.588
B	BAND 2 BEAM SELECTION ELEMENT		
	(1) Output port of beam forming lens	Part of 927419-1	0.588
	(2) RF module	928307-1	14.358
C	BAND 3 BEAM FORMING ELEMENT		
	(1) Antenna array element	Part of 928414-1	0.595
	(2) Input port of beam forming lens	Part of 927415-1	0.588
D	BAND 3 BEAM SELECTION ELEMENT		
	(1) Output port of beam forming lens	Part of 927415-1	0.588
	(2) RF module	928308-1	10.243

Table 4-2 Reliability Model Block Identification and Failure Rate Summary

BLOCK	CONTENTS OF BLOCK	ITEM PART NUMBER	λ (FAILURES/10^6 HOURS)
E	NON-REDUNDANT PORTION OF QUADRANT		
	(1) Band 2 DF Receiver excluding items covered in a_i and b_i above	926989-1	18.209
	(2) Band 3 DF Receiver excluding items covered in c_i and d_i above	926988-1	23.368
	λ_E		41.577
F	EXTERIOR ESM EXCEPT ITEMS COVERED BY a_i THRU E ABOVE		
	(1) Antenna-radome assembly, semi-omni	845676-2	0.501
	(1) Antenna-radome assembly, semi-omni	845676-1	0.501
	(2) Antenna assembly - band 1	849218-1	1.002
	(3) Amplifier, radio frequency	926484-2	227.050
	(4) Processor, signal data (angle encoder)	926996-1	191.877
	(5) Enclosure	926975-1	34.854
	λ_F		455.785

Table 4-2: Reliability Model Block Identification and Failure Rate Summary

BLOCK	CONTENTS OF BLOCK	ITEM PART NUMBER	λ (FAILURES/10^6 HOURS
G	INTERIOR ESM		
	(1) IFM, Preamp MUX	926997-2	436.464
	(2) CFR (Coarse frequency receiver)		268.811
	Receiver, countermeasures (Band 1 receiver/DCU)	926990-1	449.180
	λ_G		1154.455
H	PROCESSOR, SIGNAL DATA AND CORRELATOR	926994-2	209.957
	λ_H		209.957
J	COMPUTER AND COMPUTER INTERFACE		
	Computer, digital	929010	473.220
	Interface, computer	928399-1	12.111
	Cabinet, rack 1	926488-1,-2,-3	20.103
	λ_J		505.434

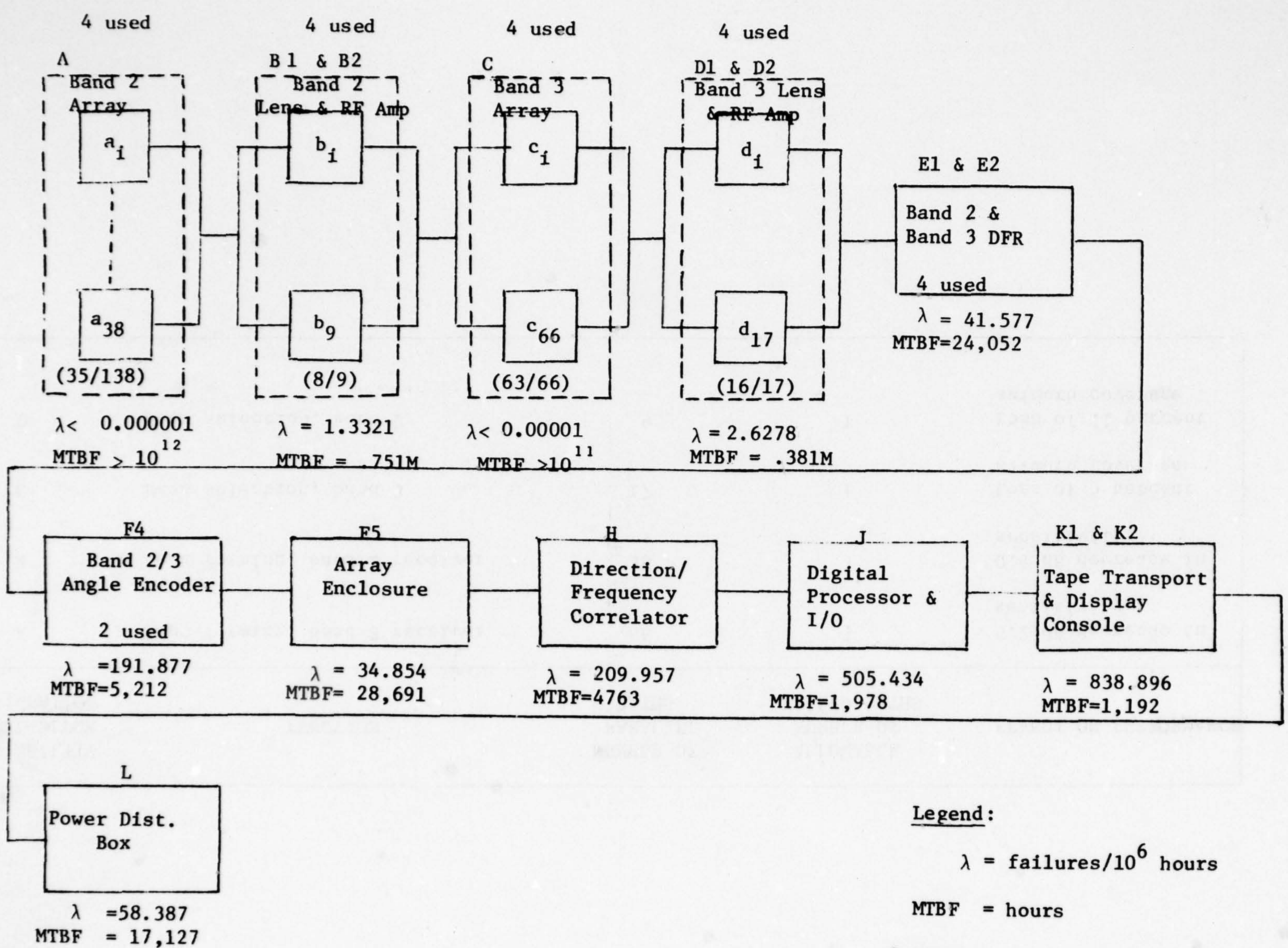
Table 4-2: Reliability Model Block Identification and Failure Rate Summary

BLOCK	CONTENTS OF BLOCK	ITEM PART NUMBER	λ (FAILURES/10^6 HOURS
K	CONSOLE		
	(1) Console - display	848066-1	819.650
	(2) Tape transport	926910-1	19.110*
	Footswitch	929171-1	0.145
L	DISTRIBUTION BOX, POWER		
		926966-1	58.387
	λ_L		58.387

*10% duty cycle factor included

Table 4-3 AN/SLQ-32(V)2 Graceful Degradation Functions

RELIABILITY MODEL BLOCK DESIGNATION	FUNCTION	NUMBER OF PARALLEL PATHS	ALLOWABLE NUMBER OF FAILED PATHS	EFFECT ON PERFORMANCE
A	Beam forming, band 3 receiver	66	3	0.2 dB decrease in sensitivity
B	Beam forming, band 2 receiver	38	3	0.4 dB decrease in sensitivity
C	Beam selection, band 3	17	1	Loss of 5 percent azimuth coverage
D	Beam selection, band 2	9	1	Loss of 11 percent azimuth coverage



Legend:

λ = failures/10^6 hours

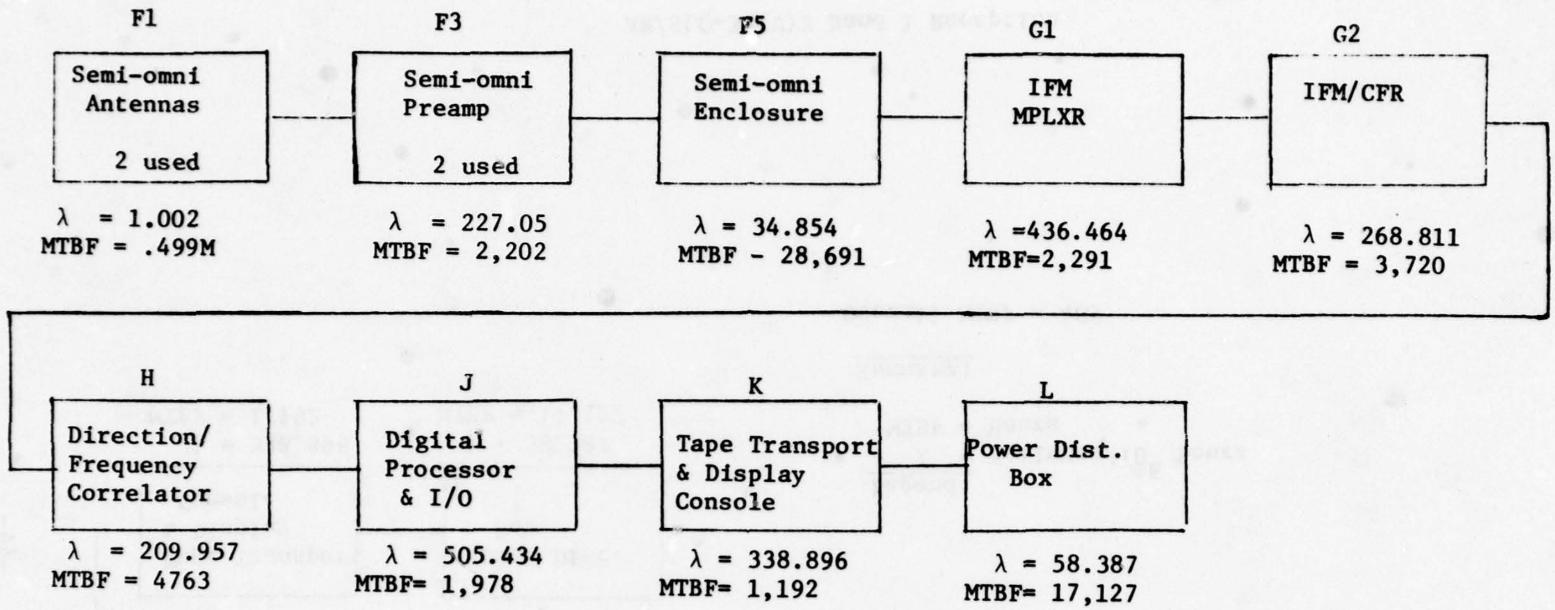
MTBF = hours

Summary:

Overall MTBF = 452

AN/SLQ-32(V)2 DF MODE

FIGURE 4-3



Legend:

λ = failures/10^6 hours

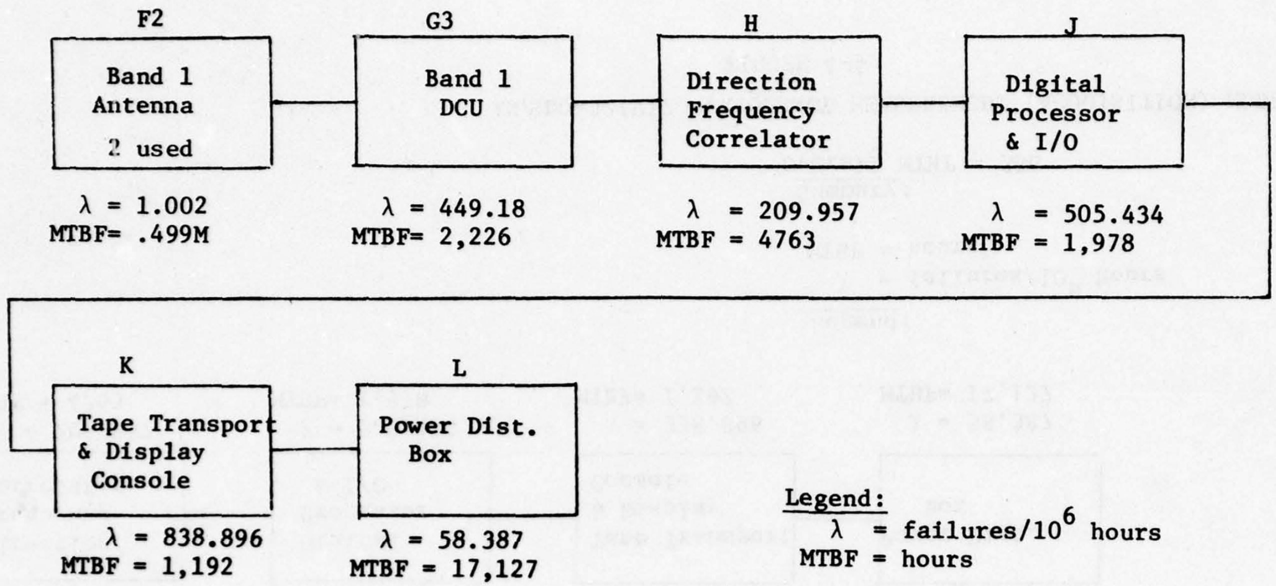
MTBF = hours

Summary:

Overall MTBF = 356

AN/SLQ-32(V)2 FREQUENCY MEASUREMENT (ACQUISITION) MODE

FIGURE 4-4



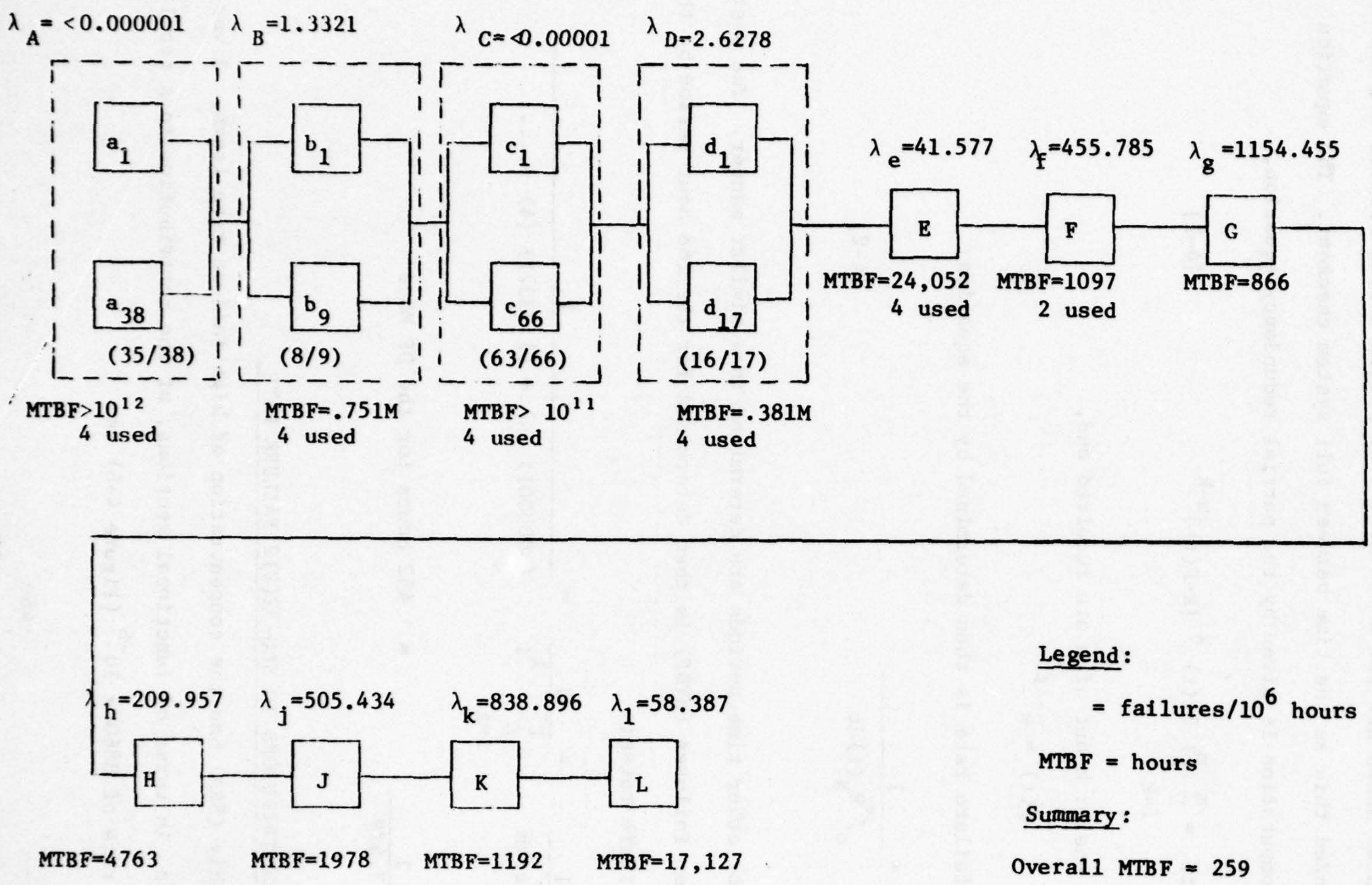
<u>Legend:</u>
λ = failures/10^6 hours
MTBF = hours

<u>Summary:</u>

Overall MTBF = 485

AN/SLQ-32(V)2 Band 1 Reception

Figure 4-5



Reliability Block Diagram SLO-32(V)2 Combined Modes

Figure 4-6

The failure rates given in figure 4-3 and 4-6 for blocks A, B, C and D are determined by the combined parallel path probability computation as a function of time. The rates shown are for a 168 hour time period chosen because the contractor has recommended this as the time between full system checkout. The equation used for this computation is given by the partial redundancy equation,

$$R_N(t) = \sum_{i=k}^{m} \binom{m}{k} P(t)^k \, [k-P(t)]^{m-k} \qquad [4\text{-}1]$$

where: k out of m are required and,

$$p(t) = e^{-\lambda t}$$

The equivalent failure rate is then determined by the equation;

$$\lambda_N = \frac{1}{\int_0^{\infty} R_N(t)\,dt} \qquad [4\text{-}2]$$

Failure rates for other time periods are determined in a similar manner. The system mean-time-between failures (MTBF) is then determined for the 168 hour period by the summation of failure rates;

$$MTBF = \frac{1}{\lambda_{system}} = \frac{1}{\sum_{i=A}^{L} \lambda_i} = \frac{1}{(.000001)\,(4) + (1.33321)\,(4) + \ldots}$$

$$= \frac{1}{2213.429} = 452 \text{ hours for the DF Mode}$$

4.2.3 <u>HIGHEST CONTRIBUTORS TO SLQ-32(V)2 FAILURE RATE</u>

No single assembly (SRA) has the concentration of high failure rate items. A very course breakdown, in terms of functional sections, of the contribution to a total system failure rate of 3860 x 10^{-6} (Figure 4-6) is:

RF	43%
Power Supplies	24%
Display	21%
Computer	12%

The power supplies consist of 18 AC to DC power supplies and 17 regulator assemblies. In the display the CRT appears to be the only single part type with a high contribution to failure rate (After semiconductors and integrated circuits). The computer is composed primarily of ICs and the core memory which contributes about 33% of the 485.3 failures/10^6 hour failure rate.

In the RF section, some of the portions showing a high contribution to failure rate are the IFM-Preamp-Multiplexer, CFR, DCU and Angle Encoder. Except for Integrated Circuits (IC's) none of those units appear to have a high concentration of high failure rate components. Among RF oscillators, directional couplers, attenuators and filters, the failure rates are well distributed. Overall, there are approximately 5000 IC's used in suite 2 with an assigned failure rate of 0.1034 failures/10^6 hours. This amounts to approximately 13% of the total system failure rate. However, these 5000 IC's are well distributed among units of the system.

4.3 MAINTAINABILITY ASSESSMENT OF THE AN/SLQ-32(V)2

The maintainability assessment of the AN/SLQ-32(V)2 relied heavily on the technical analysis already performed by the contractor. The maintainability assessment was directed mainly toward identifying the associated repair times of the functional blocks making up the suite 2 model. Within the functional blocks, there are a total

of 432 ship replaceable assemblies (SRA's) Table 4-4 provides a breakdown of the locations of the units and SRA's. The SLQ-32(V) maintenance design concept is to repair by replacement of modules (SRA's) on board ship. The units range from 3/4 to 1 1/2 ATR size units. Access to SRA's in Rack 1 is by loosening swing bolt nuts, sliding out unit, removing unit covers held with quick removal Dzus fasteners and SRA removal. Access to SRA's in the Console is by removal of 8 front panel quick disconnect type screws and sliding out console unit. Access to exterior SRA's is by opening hinged antenna enclosure panels, disconnecting and tagging cables, loosening swing bolts and removing entire assembly. Assembly covers, cables and SRA holding screw are then removed.

4.3.1 REPAIR-TIME EVALUATION FROM FIELD DATA

At the time of this study, the only field data available on equipment repair-time was from Techeval (reference paragraph 4.2.1). In addition, the repair-time data measured for 39 maintenance actions and 24 tasks performed during maintainability demonstration testing was also available. Of these, it was determined that 8 maintenance actions and 16 demonstration tasks were for equivalent suite 2 ESM hardware. The data was tabulated and is shown in Tables 4-5 and 4-6.

Table 4-5 is a summary of the observed repair time for correction of the faults that occurred during the Techeval program aboard the USS Leahy. Table 4-5 also compares the observed repair time to the repair time shown derived by Mil-Handbook prediction. Table 4-6 is a summary of the observed repair times (corrective maintenance times) from the specified maintenance tasks performed during the Maintainability Demonstration Test, reference 3. Table 4-6 also provides the predicted repair time for comparison. Demonstration data shows observed MTTR better than predicted values. Maintenance tasks during Techeval (Table 4-5)

TABLE 4-4

AN/SLQ-32(V)2 SYSTEM CONSTRUCTION

EXTERIOR EQUIPMENT

PORT		DESCRIPTION	STARBOARD	
UNIT 22	No SRA	Band 1 Antennas (mast)	Unit 32 No SRA	
UNIT 20		Array Antenna Assemblies	Unit 30	
A1		Array Antenna Enclosures		A1
	8 SRA's	Chasis Parts	8 SRA's	
A3	1 SRA	Semi-omni Antenna	1 SRA	A3
A4	1 SRA	Semi-omni Antenna	1 SRA	A4
A5	22 SRA's	Band 3 DFR	22 SRA's	A5
A6	22 SRA's	Band 3 DFR	22 SRA's	A6
A7	14 SRA's	Band 2 DFR	14 SRA's	A7
A8	14 SRA's	Band 2 DFR	14 SRA's	A8
A11	10 SRA's	Semi-omni Preamp	10 SRA's	A11
A12	29 SRA's	Angle Encóder	29 SRA's	

INTERIOR EQUIPMENT - EW ROOM

UNIT 1		RACK 1
A1	15 SRA's	IFM Multiplexer
A2	15 SRA's	IFM CFR
A3	22 SRA's	Band 1 Receiver, DCU
A4	48 SRA's	Direction/Frequency Corelator
A5	38 SRA's	Digital Computer, CP-1374
A7	7 SRA's	Rack 1 Power Distribution Box
UNIT 4		Heat Exchanger (optional)
UNIT 11		Power Distribution Box
	7 SRA's	Chassis parts

INTERIOR EQUIPMENT - CIC ROOM

UNIT 5		Operator Display Console
A1	4 SRA's	Tape Transport Assembly
A2	34 SRA's	Console

TABLE 4 - 5

AN/SLQ-32(V) TECHEVAL OBSERVED REPAIR TIME

MAINTENANCE ACTION		XN-1 OBSERVED REPAIR TIME (HR)	(V)2 PREDICTED REPAIR TIME (HR)
XN-1 MINOR FAILURES			
Display Console	4k x 16 Mem. Module 7A5A17	0.5	0.52
Unit 20	Band 2 DFR, CVR 20A12A10	1.5	1.13
Unit 30	Band 2 DFR, MPLXR 30A10A6	3.2*	1.28
XN-1 MAJOR FAILURES			
Unit 1	Memory Card 1A1A2A8	1.75	0.77
Unit 2	IFM Pre Amp 2A1A3V2	2.21	No equiv. found
XN-1 PREVENTIVE ACTION			
Display Console	Trace Alignment	0.16	-
Unit 2	IFM Sensitivity Adjust.	0.5	-
Display Console	Filter	0.1	

*Added 17.3 hour delay time recorded

TABLE 4-6

AN/SLQ-32(V) MAINTAINABILITY DEMONSTRATION DATA

DEMONSTRATED REPAIR TIMES

UNIT	FAILURE SYMPTOM	DEMONSTRATED MAINTENANCE TIME (Hrs)	AN/SLQ-32-(V)2 PREDICTION 30 JULY 78 (Hrs)
IFM MUX 1A1A3	SOT + 28V Power Supply	.61	.93
Display 5A2	Bright/Dim Characters (CARD)	.16	.52
SIOC 1A4	SDT-Serial Message (CARD)	.3	0.7
BD 3 DFR 20/ 30A5/6	+5V Power Supply (Outside)	.64	.13
BD 3 DFR 20/30A5/6	+5V Power Supply (Outside)	.97	.13
IFM MUX 1A1A3	SOT + 15V Power Supply	.93	0.93
Display 5A2	No Circle Format (CARD)	.16	.52
SIOC 1A4	SDT Serial Message (CARD)	.45	.7
(V)3 TGU	SOT IND + 15V Power Supply		-
SIOC 1A4	SDT Serial Message (A-15) CARD)	.37	.7
(V)3 TGU	SDT SSW (A-20 CARD)		
DFC/DTU 1A4	Process Control (A-6 CARD)	.25	.7
SIOC 1A4	SDT Serial Message (A-15 CARD)	.23	.7
(V)3 TGU	SOT-HDT (A-4 CARD)		-
DFC/DTU 1A4	Frequency TOL (A-15 CARD)	.2	.7
IFM/CFR 1A2	SOT-12V Regulator (A-13 CARD)	1.2	1.16
BD 2 DFR 20/ 30A7/8	-12V Regulator (Outside)	.65	.13
IFM MUX 1A1	SOT (CARD)	.21	.93
IFM PREAMP	SOT +28V Power Supply	.48	-
SIOC 1A4	Loose Cable Connector J-8	.18	-
(V)3 TGU	SDT SSW (CARD)	-	-
Display 5A2	A/N MEMORY (CARD)	.27	.52
(V)3 XMTR	TWT (BOTTOM)	-	-
(V)3 XMTR	TWT (BOTTOM)	-	-

show repair-times about equivalent to predicted values.

4.3.2 REPAIR-TIME EVALUATION BY MIL HANDBOOK PREDICTION

The maintainability prediction is provided in reference 2, Maintainability Prediction Report, CDRL A00V. The technique was based on MIL-HDBK 472. Assigned elemental task times (such as assembly/disassembly interchange times) were either taken from MIL-HDBK 472 or based on knowledge and experience with the equipment. The resultant overall MTTR from this prediction is 1.045 hours. For purposes of this study, repair-times for the corresponding blocks of Table 4-2 were extracted from the prediction and are listed in Table 4-7. The Band 1 Antenna and the Console Footswitch were assigned a repair time of 720 hours because they are not designated ship replaceable items and it was estimated the ship would return to port after 30 days.

4.3.3 ESTIMATED DOWN TIME

Although support for the evaluation stage is currently being handled by the contractor, support of the deployment stage has not been defined. As a result, the current Navy support conditions applicable to the AN/WLR-1G are assumed for this study. The delay time of 49 hours estimated for the WLR-1G Receiver (Table 3-5 and section 3.3.2) was incorporated into Operational Availability calculations for the AN/SLQ-32(V)2. By adding this delay time of 49 hours to the MTTRs given in Table 4-7, the resultant MDT used in the projected field operational availability calculations is determined by (MDT = MTTR + Delay Time).

4.4 AVAILABILITY OF THE AN/SLQ-32(V)2

The same approach used for determining availability indices for the AN/WLR-1G was used for AN/SLQ-32(V)2. Predicted repair-times (MTTR) were used to calculate

TABLE 4-7

AN/SLQ-32(V)2 PREDICTED REPAIR TIMES

BLOCK	UNIT/SRA	REPAIR TIME(Hrs.)
A	P/O 20A7, Band 2 Array	2.44
B	P/O 20A7, Band 2 Lenses	2.44
B	20A7,11,12 Band 2 CVR	.56
C	P/O 20A5, Band 2 Array	2.84
D	P/O 20A5, Band 2 Lenses	2.84
D	20A5 A2, Band 3 CVR	.56
E 1	P/O 20A7, 8, Band 2 DFR	1.35
E 2	P/O 20A5, 6, BAnd 3 DFR	1.51
F 1	20A3, Semi-omni	2.73
F 1	20A4, Semi-omni	2.73
F 2	Unit 22, Band 1 Antenna	720*
F 3	20A11, Band 2, 3 RF Amp	1.36
F 4	20A12, Angle Encoder	1.04
F 5	20A1, Exterior Enclosures	0.58
G 1	1A1, IFM-MPLXR	1.3
G 2	1A2, CFR	1.04
G 3	1A3, Band 1 DCU	1.01
H	1A4, Correlator	0.73
J	1A5, 7 Comp., I/O	0.89
K1	5A1, 2 Tape Trans & Console	0.69
K2	Footswitch	720*
L	Unit 11, Power Dist.	0.36

*not repairable aboard ship

System MTTR=1.045 Hrs.

inherent availability and operational support logistics delay reflected in the WLR-1G field data (Table 3-5) was used to calculate AN/SLQ-32(V)2 operational availability. For the AN/SLQ-32(V)2 ESM, the following statement of conditions are given:

- Models used for availability for the AN/WLR-1G are also applicable to the AN/SLQ-32
- A successful mission may be achieved for the duration of the mission even though graceful degradation has occurred.
- Spares availability is such that on the average 49 hours of logistics delay occur for each failure over a 1 year period*.

Finally, the availability calculations for the separate modes (Tables 4-8 through 4-11) were computed by means of the math models presented in Appendix D.

4.4.1 DISCUSSION OF AVAILABILITY RESULTS

The resultant calculations of availability are shown in Tables 4-8 through 4-11 The change in inherent availability over the 7 to 365 days is seen to occur only for the DF mode and combined mode operation. This effect is due to the fact that the failure rate for blocks A, B, C and D are the only significant parameter changes with time. A steady state inherent availability has been reached at 7 days and only the small increase in failure rate for blocks A through D are reflected in the calculations. Because of this effect, steady state inherent availability ($A_{I\ steady\ state}$) may be approximated by the steady state equation,

$$A_{I\ steady\ state} \quad \frac{MTBF}{MTBF + MTTR}$$

*Because delay time was only known for a one year period, Operational Availability was not calculated for other periods.

TABLE 4 - 8

AN/SLQ-32(V)2 DF Mode Availability

REL BLOCK	DESCRIPTION	$F/10^6$ HRS.	No. of PARALLEL PATHS	QTY USED	REPAIR TIME (HRS.)	DOWN TIME (HRS)
A	BAND 2 ANTENNA ARRAY & LENS INPUT	1.183	35/38	4	2.44	51.44
B 1	BAND 2 LENS OUTPUT	0.588	8/9	4	2.44	51.44
B 2	BAND 2 CVR	14.358	8/9	4	.56	49.56
C	BAND 3 ANTENNA ARRAY & LENS INPUT	1.183	63/66	4	2.84	51.84
D 1	BAND 3 LENS OUTPUT	0.588	16/17	4	2.84	51.84
D 2	BAND 3 CVR	10.243	16/17	4	.56	49.56
E1	BAND 2 DFR Not in blocks A-D	18.209	0	4	1.35	50.35
E2	BAND 3 DFR Not in blocks A-D	23.368	0	4	1.51	50.51
F4	ANGLE ENCODER	191.877	0	2	1.04	50.04
F5	ARRAY ENCLOSURE	34.854	0	1	.58	49.58
H	DIRECTION/FREQUENCY COORELATOR	209.957	0	1	.73	49.73
J	DIGITAL PROCESSOR & I/O	505.434	0	1	.89	49.89
K1	TAPE TRANSPORT & DISPLAY CONSOLE	838.751	0	1	.69	49.69
K2	FOOT SWITCH	0.145	0	1	720	720
L	POWER DISTRIBUTION BOX	58.387	0	1	.36	49.36

PARAMETER	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	.99811606	.99809068	.99809068	.99807102	.99804375
OPERATIONAL AVAILABILITY	—	—	—	—	.82210941

TABLE 4 - 9

AN/SLQ-32(V)2 Frequency Measurement (Acquisition) Mode Availability

REL BLOCK	DESCRIPTION	$F/10^6$ HRS.	No. of PARALLEL PATHS	QTY USED	REPAIR TIME (HRS.)	DOWN TIME (HRS)
F1	SEMI-OMNI ANTENNAS	1.002	0	2	2.73	51.73
F3	SEMI-OMNI PREAMPS	227.05	0	2	1.36	50.36
F5	SEMI-OMNI ENCLOSURE	34.854	0	1	.58	49.58
G1	IFM MPLXR	436.464	0	1	1.3	50.3
G2	IFM/CFR	268.811	0	1	1.04	50.04
H	DIRECTION/FREQUENCY CORRELATOR	209.957	0	1	.73	49.73
J	DIGITAL PROCESSOR & I/O	505.434	0	1	.89	49.89
K1	TAPE TRANSPORT & DISPLAY CONSOLE	838.751	0	1	.69	49.69
K2	FOOT SWITCH	0.145	0	1	720	720
L	POWER DISTRIBUTION BOX	58.387	0	1	.36	49.36

PARAMETER	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	.99706320	.99706320	.99706320	.99706320	.99706320
OPERATIONAL AVAILABILITY					.87055485

TABLE 4- 10

AN/SLQ-32(V)2 Band 1 Reception Availability

REL BLOCK	DESCRIPTION	$F/10^6$ HRS.	No. of PARALLEL PATHS	QTY USED	REPAIR TIME (HRS.)	DOWN TIME (HRS)
F2	BAND 1 ANTENNA	1.002	0	2	720	720
G3	BAND 1 DCU	449.18	0	1	1.01	50.01
H	DIRECTION/FREQUENCY COORELATOR	209.957	0	1	.73	49.73
J	DIGITAL PROCESSOR & I/O	505.434	0	1	.89	49.89
K1	TAPE TRANSPORT & DISPLAY CONSOLE	838.751	0	1	.69	49.69
K2	FOOT SWITCH	0.145	0	1	720	720
L	POWER DISTRIBUTION BOX	58.387	0	1	.36	49.36

PARAMETER	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	.99802220	.99802220	.99802220	.99802220	.99802220
OPERATIONAL AVAILABILITY	—	—	—	—	.90234184

TABLE 4 - 11

AN/SLQ-32(V)2 System Availability

REL. BLOCK	DESCRIPTION	$F/10^6$ HRS.	No. of PARALLEL PATHS	QTY USED	REPAIR TIME (HRS.)	DOWN TIME (HRS)
A	BAND 2 ANTENNA ARRAY & LENS INPUT	1.183	35/38	4	2.44	51.44
B	BAND 2 LENS OUTPUT	0.588	8/9	4	2.44	51.44
B	BAND 2 CVR	14.358	8/9	4	.56	49.56
C	BAND 3 ANTENNA ARRAY & LENS INPUT	1.183	63/66	4	2.84	51.84
D	BAND 3 LENS OUTPUT	0.588	16/17	4	2.84	51.84
D	BAND 3 CVR	10.243	16/17	4	.56	49.56
E1	BAND 2 DFR Not in blocks A-D	18.209	0	4	1.35	50.35
E2	BAND 3 DFR Not in blocks A-D	23.368	0	4	1.51	50.51
F1	SEMI-OMNI ANTENNA	1.002	0	2	2.73	51.73
F2	BAND 1 ANTENNA	1.002	0	2	720	720.
F3	SEMI-OMNI PREAMP	227.05	0	2	1.36	50.36
F4	ANGLE ENCODER	191.877	0	2	1.004	50.004
F5	EXTERIOR ENCLOSURE	34.854	0	2	.58	49.58
G1	IFM MPLXR	436.464	0	1	1.3	50.3
G2	CFR	268.811	0	1	1.04	50.04
G3	BAND 1 DCU	449.18	0	1	1.01	50.01
H	DIRECTION/FREQUENCY CORRELATOR	209.957	0	1	.73	49.73
J	DIGITAL PROCESSOR & I/O	505.434	0	1	.89	49.89
K1	TAPE TRANSPORT & DISPLAY CONSOLE	838.751	0	1	.69	49.69
K2	FOOT SWITCH	0.145	0	1	720	720
L	POWER DISTRIBUTION BOX	58.387	0	1	.36	49.36

PARAMETER	7 DAYS	30 DAYS	90 DAYS	180 DAYS	365 DAYS
INHERENT AVAILABILITY	.99565141	.99564342	.99562609	.99560648	.99557928
OPERATIONAL AVAILABILITY	—	--	--	--	.75280336

where values for MTBF are taken directly from the reliability block diagrams (figures 4-3 through 4-6) and the system MTTR in Table 4-7. The steady state operational availability ($A_{o\ steady\ state}$) may be approximated by,

$$A_{o\ steady\ state} \quad \frac{MTBF^1}{MTBF^1 + MDT}$$

where values for $MTBF^1$ and MDT must be derived from the parameters listed in Tables 4-8 through 4-11. The derivation is shown below and the results given for only the combined mode (Table 4-11).

The DF Mode (bands 2 and 3) has the highest inherent availability figure due to the antenna array redundancy. The redundancy results in a failure rate that is lower than for the Frequency Measurement Mode or Band 1 Reception Mode.

The Operational Availability for Band 1 Reception is seen to be the highest of the three modes of operation for the AN/SLQ-32(V)2. It is interesting to note that although inherent availability is highest for the DF Mode (bands 2 and 3), operational availability is not. The reason for this effect is due to the assumptions made for operational availability, i.e., operational availability requires total system (or mode) fully up. Thus, all the blocks become series paths. To have the entire system, for example, in a fully operational condition, all block failure rates in Table 4-11 are summed and found to be 5783 failures/10^6 hours, or, 173 hour MTBF. The associated MDT is found to be 50 hours by taking the average of the failure-rate-weighted down times in Table 4-11, and, the approximate steady state operational availability is;

$$A_{o\ steady\ state} \quad \frac{MTBF^1}{MTBF^1 + MDT} \quad \frac{173}{173 + 50} = 0.776$$

The added effect of using non-ship-repairable items (band 1 antenna and the foot switch) may be assessed by comparing the inherent availability for Band 1 Reception (Table 4-10) with the availability computation excluding the two items. Band 1 Reception availability for a 7 day period and excluding blocks F2 and K2 in Table 4-10 is 0.99834522 compared to 0.9980222 for the complete Band 1 availability in Table 4-10. The effect would be even less for the other modes considered.

5.0 RESULTS AND CONCLUSIONS

The objective of this study was an attempt to form the most representative availability models of the AN/WLR-1G and the AN/SLQ-32(V)2 in order to obtain insight into the areas that significantly affect availability of an ESM equipment. By concentrating on these areas, future improvements to ESM availability may be pursued in an effective manner. In this regard, the current study will serve as a "baseline" for the ESM Availability Improvement Program.

5.1 LIMITATIONS TO AVAILABILITY OF THE AN/WLR-1G and AN/SLQ-32

A. Inherent Availability

Inherent availability is a function of both failure rate and MTTR. Thus, improvements in inherent availability must necessarily start with these factors while insuring that the stated ESM performance goals are not degraded.

In the AN/WLR-1G any improvements to inherent availability is related mainly to replacing the IP-480 by a state-of-the art IF processor and display unit. No significant improvement in inherent availability could be achieved by merely making internal modifications to the IP-480; a complete technology shift from vacuum tubes and RV resistors and CRT displays is required. In addition, circuit redundancy and self-test features throughout the AN/WLR-1G is lacking. These features should be added for additional improvement in inherent availability. A course estimate of the boundry of improvement to be expected by a new IP-480 design would be about a maximum of 144 hour MTBF for the Combined Mode (from 106 hours), assuming that the new IP-480 would have a failure rate of 1000 failures/10^6 hours rather than 3490 f/10^6 hours shown in figure 3-6. The power supplies and Frequency Converter (CV-742) could be improved similarly (to failure rates of 1000 and 500 failures/10^6 hours for power supplies and

CV-742 respectively). Assuming replacement (collective improvement) of these items, the overall maximum expected system MTBF would be approximately 193 hours.

If an overall maximum MTBF of 193 hours is obtained this would (using an MTTR of 3.35 hours from Table 3- 6), enhance availability as follows:

$$A_{\text{steady state}} = \frac{\text{MTBF}}{\text{MTBF + MTTR}} = \frac{193}{193 + 3.35} = 0.983^{*}$$

The study of the AN/SLQ-32(V)2 has shown that although the complexity is high, the predicted reliability is also reasonably high. This is not meant to imply that it could not be significantly improved. The primary reason for its higher reliability is the application of digitized circuitry with its low power, low failure rate IC circuitry.

As the SLQ-32(V)2 now exists, an inherent availability of approximately 0.996 is realized. This valve may be approximated by the equation,

$$A_{\text{steady state}} = \frac{\text{MTBF}}{\text{MTBF + MTTR}} \tag{5-1}$$

For an MTBF of 259 hours and an MTTR of 1 hour,

$$A_{\text{steady state}} = \frac{259}{260} = 0.996$$

In order to realize an inherent availability of 0.998, the reliability must be doubled;

$$\text{MTBF} = \text{MTTR}\left(\frac{A}{1-A}\right) \text{ steady state} = 1.0\left(\frac{.998}{.002}\right) = 499 \text{ hours}$$

It is very unlikely that the SLQ-32(V)2 reliability could be doubled merely by a design change, lowering stress levels or effecting parts quality improvement. Added redundancy would probably be the most feasible method of design change to improve the MTBF.

*Compared to results of 0.968 from Table 3-10.

Improving availability in either the AN/SLQ-32(V)2 or the AN/WLR-1G by improving maintainability may be seen as being less practical, even for the AN/SLQ-32(V)2. For example:

$$MTTR = MTBF\left(\frac{1-A}{A}\right)_{\text{steady state}} = 259\left(\frac{.002}{.998}\right) = 0.52 \text{ hours}$$

An MTTR of 0.5 hours is probably not feasible without a considerable amount of added built-in self test and re-packaging exterior equipment.

B. Operation Availability

Operational availability is a function of support and logistics in addition to failure rate and MTTR. Thus it relates to equipment design and established logistics support.

Study of the field data for the WLR-1G system showed logistics delay time (Table 3-5) accounting for most of the operational down time. This observed delay time so overwhelms the inherent repair time that it would seem futile to attempt improving the design. This conclusion, however, may not necessarily be the correct conclusion. Logistics delay may be the time spent awaiting parts, time spent awaiting technical assistance or time spent awaiting test equipment. Most often delay time is the time spent awaiting parts. The 3-M data showed that nearly 50% of the parts demanded were not on-board when required -- tubes being the highest in demand for that time period. This condition is indicative of supply constraints. No matter what is done to the design, short of making it self-healing, no significant improvement would be realized in availability with such a high delay time.

Finally, the 3-M data indicated that some parts designed into the equipment are not readily available. That is, parts are either non-standard or require unique manufacturing processes such as the gearing in the antenna or the RF modules in the tuners.

Although the parts may be obtained, often long lead times are required because a manufacturer discontinues production or is not always in production. Design of equipment with many unique or non-standard parts, therefore, may result in promoting long delays in logistics.

No reason could be found in the research of the 3-M data as to why supply line conditions exhibit the relatively long delays. It is the writer's opinion that this delay time is more reprsentative of day to day activities where little or no priority is assigned to obtain replenishments. For those failures where mission operation was critical, a normal system of priority in the naval supply system would expedite the required material at a faster rate than normal. An in-depth study of CASREP data would be required to determine if, in fact, a problem of long delay time does exist in the supply system when priority requisitions are involved.

Nevertheless, it is clear that operational availability for both the AN/WLR-1G and the AN/SLQ-32(V)2 is impacted most by delay time. Clearly replenishment support must be improved and a philosophy implemented to ensure that standard parts are used as much as possible in ESM design.

5.2 AVAILABILITY GUIDELINES FOR FUTURE ESM

The results in section 5.1 based on a review of the AN/WLR-1G and the AN/SLQ-32(V)2 indicate that achieving an MTBF of 500 hours and an MTTR of 0.5 hours may represent upper limits. These data are tabulated in Table 5-1 to show the effects upon availability.

TABLE 5 - 1

Probable Achieveable Ultimate ESM Availabilities

MTBF (hours)	MTTR (hours)	Availability	Difficulty
250	1.0	0.996	modest
250	0.5	0.998	hard
500	1.0	0.998	hard
500	0.5	0.999	very hard

Design efforts to obtain these goals must consider the following:

1. Use of self-test features

2. Use of standard components based on a low failure rate technology

3. Implementation of redundancy -

    a. Adoption of techniques (for example: antennas) wherein performance "gracefully" degrades with component failure.

    b. Separation of performance functions into several modes of operation wherein failure of one mode would still permit mission success in some acceptable degraded capability

4. Quality Assurance and Quality Control during the procurement and development stages

5. Mechanical design to facilitate access and to minimize environmental effects

5.3 RECOMMENDATIONS

The following studies are proposed based upon conditions discovered during reliability analysis of the AN/WLR-1G and the AN/SLQ-32(V)2:

1. Study of CASREPS to determine if supply line constraints are causing unnecessary down time.

2. Study of the CV-3599 replacement for the CV-741 and CV-742 to determine its effect on AN/WLR-1G MTBF.

3. Study of the feasibility of replacing the IP-480 and Power Supplies (PP 21560 and PP 2157D).

4. Study of the AS-899 Antenna drive train mechanization to determine what may be causing coupling failures.

5. Study of the CV-1162A Tuner regulator to determine what may be causing abnormal high failure rate.

The studies are proposed in the order or priority. However, it has been indicated that data may be currently available that would minimize the extent of studies 2 and 3.

GLOSSARY OF ABBREVIATIONS

CASREP	Casualty Report
CDRL	Contract Data Requirements List
CFR	Coarse Frequency Receiver
CIC	Combat Information Center
DCU	Digital Control Unit
IFM	Instantaneous Frequency Measuring (Receiver)
MDT	Mean Down Time
MTBF	Mean Time Before Failure
MTTR	Mean Time To Repair
Mux	Multiplexer
PMS	Planned Maintenance Sub-system
RAC	Reliability Analysis Center (Ref 6)
RMA	Reliability, Maintainability and Availability
SRA	*Ship Repairable Assemblies*
MIL-HDBK	Military Standardization Handbook
Mag Amp	Magnetic Control Amplifier (AM-1017)
RF SW	Radio Frequency Switch
RV	Resistor, Variable
P/O-WLA-3B	Part of AN/WLA-3B

REFERENCES

1. Technical Manual, Organizational and Intermediate Maintenance With Parts List, AN/SLQ-32(V) Countermeasures Set, Document No. 061290633, 1 September 1978.

2. Maintainability Analysis And Prediction Report, CDRL NO. A00V, Raytheon Document No. 0612900626, 30 July 1978.

3. DTPEW System Techeval RMEA Final Report, prepared by Columbia Research Corporation for NAVELEX PME 107 under Contract N00189-77-C-0207, 7 March 1977.

4. Reliability Prediction Report, CDRL A00N, Raytheon Document No. 061290625, 15 July 1978.

5. Handbook, MIL-HDBK-217B, Reliability Prediction of Electronic Equipment

6. Nonelectronic Parts Reliability Data, Published by Reliability Analysis Center, Order Number NPRD-1.

7. Mechanical Design and Systems Handbook , Harold Rothbart, McGraw Hill, 1965.

—APPENDICES TO REPORT
ON AVAILABILITY STUDY OF
THE WLR-1G AND SLQ-32(V)2 ESM SYSTEMS

CDRL A001

CONTRACT NO. N66001-78-C-0318

CONTENTS

APPENDIX A

3-M FIELD DATA WORKSHEETS

Appendix A is a reduction of the raw 3-M data to identify maintenance actions to units, assemblies and repair-time. The data is for WLR-1G receiver only and is arranged by year and ascending unit number. An asterisk (*) by the man-hours indicates time spent on several actions with that job sequence number. The "REF" column references the maintenance action. For actions taken where more than one replacement occurs, the reference number will be the same.

[illegible] TO 3-M DATA ANALYSIS

UNIT	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3DU	ATC	AER	CUE	3PS	REF
1	A2R45	7*	CV64		2	1	2	7	1	7
4	A3V1	6	DD948		2	1	–	7	3	13
5	A1CR1	–	CV64		–	–	–	–	–	5

[illegible]	[illegible]	WARD HOURS	[illegible]	PROBLEM	3DC	ATO	AER	UUR	3PM	[illegible]
12	A13R10	9*	CV64		2	1	2	7	1	7
..	A1V3	4	DDG 13		2	1	–	7	1	18
16	V4, V6, V12, T1	4*	FFG 2		2	1	2	5	2	21
17	K19	9*	DD951		2	1	–	7	2	16
19	A1XY2, Y2	4*	DD951		2	1	–	7	2	16
31										

[illegible] WEIT 10 STM DATA ANALYSIS

[illegible]	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3DC	AC	DER	JCC	3AS	REF.
1A1	CR1	5	DD 951	DURING INSPECTION, NORMAL WEAR, REDUCED CAPABILITY	4	1	–	7	3	31
3A1	CR1	1	DD 951		6	1	–	7	1	33
	A1CR1	1	CG 18		2	1	–	7	3	141
	A3V1	–	DD 845		–	–	–	–	–	131
	A1CR1		CG 21							167
4A1	CR1	5	DG 12		3	1	2	7	3	64
	V1	8	DG 12		3	1	–	7	1	65
5A1	A2V7-UBE	1 *	CG 27		2	3	–	7	2	173

... , ... WLR ... 15

	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	OCCURRENCES 3DC	ATC	PER	CUR	3AS	REF
1A 6	A4 V1	2	55N 578		2	1	-	7	3	95
	CA... OSC	12	CG 19	BAD CAVITY IN BAND 6	2	1	2	0	3	157
	A4V1 TUBE 6	1 *	CG 27		2	3	-	7	2	173
	A5 A1VR1	20	CG 27		2	1	-	7	3	181
1A7	R2	4	DD951		2	2	-	7	3	35
	A8 CR1	4	DG 7	VOLT METER SHORTED	6	1	-	7	1	52
	A3 C21	2	55N 578		2	1	-	7	3	77
A10	A2Y6, Y10	50 *	DD 948		1	1	-	1	2	25
	IF STRIP	8 *	DG 12	ALIGN IF STRIPS	3	3	1	7	[illegible]	68
	A1V3 V10	2	CG 18		2	1	-	7	1	148
	A1V3	-	DD 951		-	-	-	-	-	32

[illegible]	CIRCUIT SYMBOL	MAN HOURS	S. [illegible]	PROBLEM	[illegible] 3DU	4-0	AER	JUL	3AG	REF.
A9	A5 VR2	-	[illegible]							38
A10	J1	- *	DG07		-	-	-	-	-	54
	A1L5	-	CG21		-	-	-	-	-	164
A13	G1									183
	R35				-	-	-	-	-	165

[illegible] 13, YEAR WEATHER

	SYMBOL	HOURS	[illegible]	PROBLEM	3DU	[illegible]	JUN	JUL	3AU	KEY
A16	T1	12	DD 743		2	1	–	7	2	14
	A2 R19		DD 743							16
	T1	24	DD743							17
	~~414~~		~~DD 948~~							~~23~~
	415, 16, 14, 11	30	DD 948							23
	[illegible], A1B1	3*	DG 60		1	1	–	7	2	47
	A4 VI	2	~~SSN 578~~		2	1	–	7	3	~~95~~
	1GC4	–	DD 836		–	–	–		–	128
17	424	–*	DD 845		–	–	–	–	–	131
A29	K1502	20	CG 28		2	1	–	7	3	181

PERIOD: 1975

WLN[illegible]

[illegible]	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	JAJ	4-C	AUG	JUL	3AS	REF
A11	V11, TUBE [illegible]	50 *	DD948		1	1	-	1	2	35
..	A2L6, L15, L14	- *	DG07		-	-	-	-	-	54
	A1V1	8	DG12		1	-	-	7	3	5960
	IF STRIP	8 *	DG12	ALIGN IF STRIP	3	3	1	7	3	68
	A1L3	10	CG28		2	1	-	7	3	187
A12	13B1	43	DD951	SHORTED RELAY	2	1	2	7	3	37
	A15C1	30	DG6		1	1	-	7	1	40
	A13R7	3	DG12		2	1	2	7	3	59
	1V2	1	DG12		2	1	-	2	3	58
	A13R10	10	DG12		[illegible]	1	2	7	3	62
	A13B1	-	DG14		-	-	-	-	-	70
	SHIELD, A15P1, A15P2, J1, A15P9, BAND 7	2			3	-	2	0	2	73
	A4V1	60	CG18		2	1	-	7	1	150
	A12B1	1	CG19		2	-	2	0	3	156
	12A1	2	CG28		2	1	-	7	3	183
	12A1B1	10	CG28		2	1	-	7	3	186

WLP. 17

No.	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3DD	4-D	AUR	JUR	3AS	REF
12 (Cont.)	A13B1	–	DDG 7		–	–	–	–	–	52
..	A2CR1	–	DD 845		–	–	–	–	–	132

ANALYSIS

UNIT	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES WUC	A T	DER	SCE	WDS	REF.
1	1A1L26	30	DDG 6		6	2		6	2	62
1	1A1A	18	DDG 18		6	2		2	3	137
1		2*	[illegible]	REPAIR CV732	2		1	7	2	184
1		13*	FF1045	BAND 1 INOP.	4	1	2	6	3	268
2	[illegible]	35	CG 28	PRESELECTOR BAND 2	4	1	2	7	1	253
2		2*	DDG18	REPAIR CV 733	2		1	7	2	124
3	CV734	12	CG17	3A2 DEFECTIVE	6	1	2	7	3	215
5	5V1	26	DDG 6		2	1		7	3	65
7	[illegible]	11	DDG 7		6	1		7	3	73
7		1	CG 19	WAVEGUIDE BAND 7 WLR-16	4		6	1	3	222
7		13*	FF 1045	BAND 7 INOP.	4	1	2	6	3	268

UNIT	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3DC	ATC	AER	CUE	3AS	REF.
8		2.1	DDG 9	[illegible] 2 MIXER BLOCK BAD	6	1	2	7	3	79
8	2A5A1VR2	7	DDG13		2	1		7	3	112
9	9A5A1CR5 9A5A1VR1 9A5A2Q1	6	DDG 7	BAD IC IN 9A5 SUBASSY.	2	1		7	3	71
9	9A5VR2	14	DD951		2	1		7	1	43
9	MIXER ASSY. 9A4Y1	14	DDG12	BAND 9 OFF FREQ. 9A4Y1	4	1	1	7	2	89
9	9A4Y1	3	DDG12		2	1		7	3	100
9	9A5A1	3	DDG12		2	1		7	3	140
10	10A1V1V9	57*	DDG 7		2	1		7	2	75
10		11	DDG 7	ALIGN CV741	[illegible]	2		[illegible]	[illegible]	76
10	10A1V1 96 MV0 96 YAV0 5910 233 3166 5905 442 6320 5950 417 9576 ([illegible])	30	CG28		6	1		7	1	257
11	11A1V 11A2V 455865 907 2445 (osc.) 43 495 293 2299 (switch)	56	FFG 2	AMP BAD	6	1	4	7	3	162

1976 JAN – SEPT WLR-1G

UNIT	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3DC	ATC	AER	JUL	3AS	REF
12	12A13R1	8	DDG13		2	1		7	1	109
12	12T3	1	FFG1	REPLACE T3 UNIT 12	3		2	7	3	153
12	12CRS 12T1	12	SSN571		1	3		2	1	172
12	12A3R38	2*	CGN25		6	1		7	3	222
12	12A1V1	2	CGN25		2	1		7	1	222

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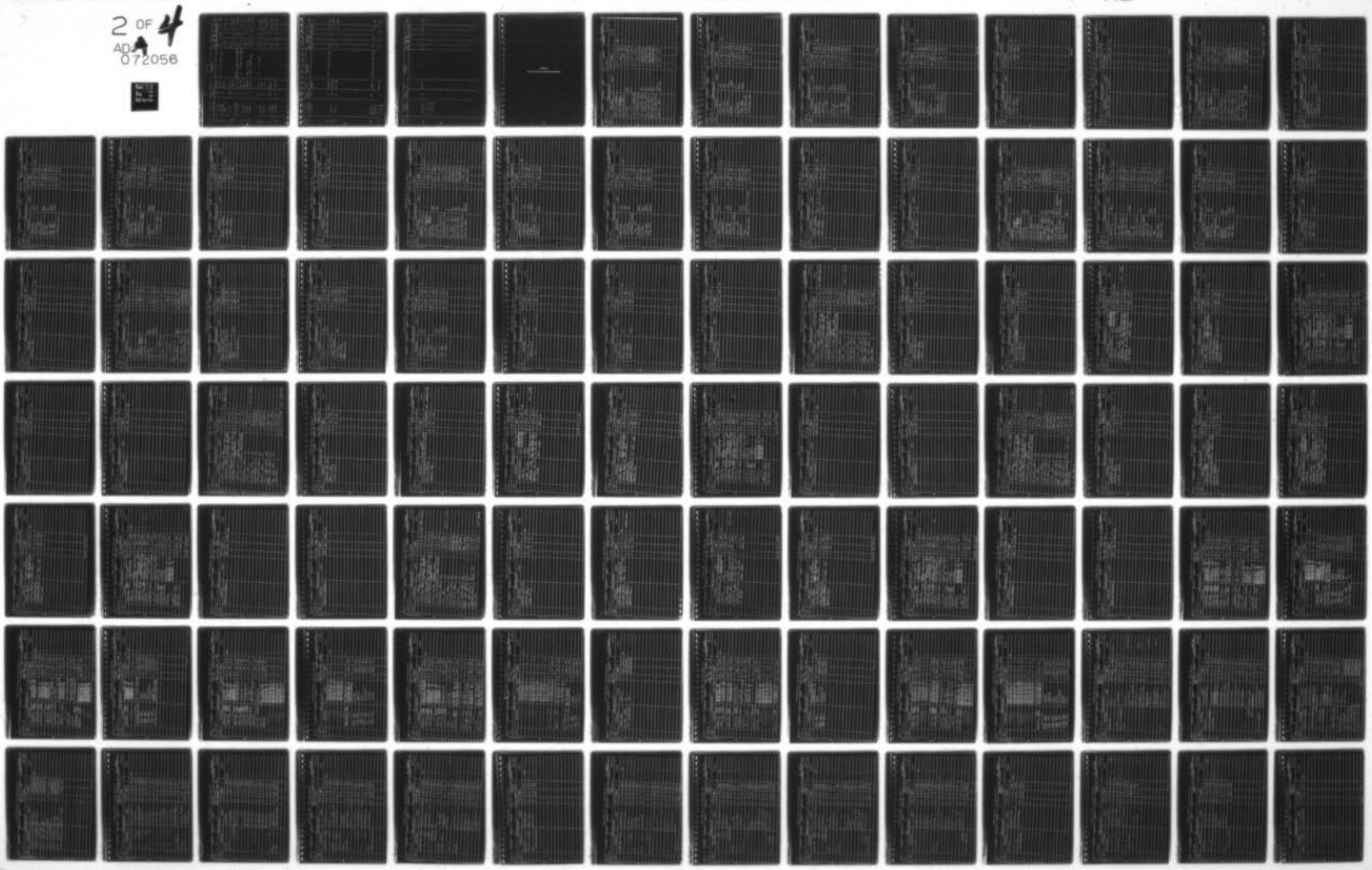


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WLR 10

UNIT	CIRCUIT SYMBOL	MAN HOURS	CHIP	PROBLEM	CODES 3AU	ATC	ALL	UUL	3AS	REF
12	12A2V2	2	DD 948		2	1		7	2	22
12	12A12B1	4	DD 948	B1 DEFECTIVE VERT SCAN	2		2	7	3	29
12	12A12B1 12A	4	DDG 6		6	1		7	3	52
12	12A13	24	DDG 6		2	1		7	3	61
12		4	DDG 12		2	1	2	0	1	101
12	12A1A1V3, 12A1A4V1	6	DDG 12	REPLACE 12A1A1V3 + 12A1A4V1	2	1	2	7	1	107
13		6	DD 942	WLR-10 STORAGE CHAN. BROKEN	2	1	2	7	3	27
13	13A4S11	2	DDG 15		2	1		7	3	112
13	13A1K1	9	DD 836	13A1K1 FAILED	5	1		7	3	126
13	13A1G1	16	CG 17	C-2697 DEFECTIVE	2	3	2	2	1	214
15		34	DDG 8	CLA... PP-2156	3	1	6	7	2	77
15	15A17P13	6	CG 17		7	1	2	5	1	212
15	15V10	6	CG 21		11	1		7	3	223
16	16XV5 16R32	57*	DDG 7		2	1		7	2	75
16	16C36	15	CG 28		2	1		7	1	262

UNIT	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3AU	A TU	AER	UCN	3AS	REF.
17	17K28	3	DD948		2	1		7	3	31
19		2	DD818	REPAIR SG-133 AC LINE	3		1	1	2	183
19	19A1T1	2	CGN 25		6	1		7	3	222
19	19Y1	2	CGN 25		2	1		7	3	230
30	30 MP? 30 MP9 30 MP10	30	DDG 6	REPLACE SYNC AMP PART	2	1	2	1	3	54
30	30 MP12 30 MP21 30 MP22	2	DDG 12		6	1		0	1	93

UNIT	CIRCUIT SYMBOL	MAN HOURS	SHIP	PROBLEM	CODES 3DU	2-3	AUR	JUR	3AS	REF.
31	31A1V3 [illegible] 729 1089 [illegible] 578 1652 1405 4[illegible] 0777 [illegible] 949 1432	4	DDG12		2	1		7	2	106

APPENDIX B

WLR-1G RELIABILITY PREDICTION WORKSHEETS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF 1
WLR-16				1 CV-7320			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER, COAXIAL		2	1.1	2.2	N.S
	FILTER, BANDPASS		2	.066	.132	"
	CONNECTOR, RACK + PANEL		1	.56	.56	"
	RESISTOR	RA	3	8.6	25.8	"
	RESISTOR	RV	1	22.0	22.0	"
	SWITCH, SENSITIVE		2	1.1	2.2	"
	TRANSFORMER, PWR.		1	.064	.064	"
	PRESELECTOR ASSY.	A1	1	55.467	55.467	"
	IF PREAMP. ASSY.	A2	1	113.346	113.346	"
	OSCILLATOR ASSY.	A3	1	36.563	36.563	"
	SERVO DRIVE ASSY.	A4	1	55.472	55.472	"
	MAN. TUNE DRIVE ASSY.	A 6	1	1.74	1.74	"
	COUPLING ASSY.	A8 + A9	2	NEG.	NEG.	"

SUM OF Nλ: 312.54 [illegible] 3.19 [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 1	ASSEMBLY: A1	SUBASSEMBLY:	
WLR-16				CV-732D	PRESELECTOR		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CK	4	.44	1.76	N_S
	CAPACITOR	PC	1	.47	.47	"
	CAPACITOR	CM	2	.078	.156	"
	DIODE	1N263	1	17.0	17.0	"
	COIL	RF	1	.066	.066	"
	RESISTOR	RCR	2	.0077	.015	"
	TUBE, REC.	5842	1	32.5	32.5	"
	CONDENSER, VAR.		2	.10	.20	"
	CONNECTOR, COAX.		3	1.1	3.3	"

SUM OF Nλ: 55.467

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM: WLR-16	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 1 CV-732D	ASSEMBLY: A2 IF PREAMP	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CC	2	.44	.88	Ns
	CAPACITOR	PC	3	.47	1.41	"
	CAPACITOR	CK	23	.44	10.12	"
	COIL, VAR.		1	.066	.066	"
	COIL	RF	16	.066	1.056	"
	RESISTOR	RCR	7	.0077	.054	"
	RESISTOR	RN	2	.03	.060	"
	TUBE, REC.	5654	2	32.5	65.0	"
	TUBE, REC.	5670	1	32.5	32.5	"
	CONNECTOR, COAXIAL		2	1.1	2.2	"

SUM OF Nλ 113.346

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 1	ASSEMBLY: A3	SUBASSEMBLY:	
WLR-1G				CV-7320	OSC.		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONDENSER		1	.10	.10	NS
	CAPACITOR	CC	2	.44	.88	"
	CAPACITOR	CK	2	.44	.88	"
	COIL	RF	1	.066	.066	"
	RESISTOR	RCR	2	.0077	.015	"
	TUBE	5718	1	32.5	32.5	"
	CONNECTOR COAX.		1	1.1	1.1	"
	CAPACITOR, MICA		1	.99	.99	"
	CAPACITOR, FIXED, PLASTIC		2	.016	.032	"
				SUM OF Nλ	36.563	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 1	ASSEMBLY: A 4	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				CV-732D	SERVO DRIVE		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, CONTROL	—	1	55	55.0	Ns
	GEAR, IDLER		1	.236	.236	"
	GEAR, CLUTCH		1	.236	.236	"
			SUM OF Nλ		55.472	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				CV-732D	AG MAN. TUNE DRIVE		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	GEAR SHAFT, SPUR	ALUMINUM	1	1,74	1,74	N_S

SUM OF Nλ 1,74

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	DATE 10/25/78
WLR-16				2 CV-733D			SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER, COAXIAL		2	1.1	2.2	Ns
	FILTER		2	.066	.132	"
	CONNECTOR PACK & PANEL		1	.56	.56	"
	RESISTOR	RA	3	8.6	25.8	"
	RESISTOR	RV	1	22.0	22.0	"
	SWITCH, SENSITIVE		2	1.1	2.2	"
	TRANSFORMER, PWR		1	.064	.064	"
	REFLECTOR ASSY.	A1	1	20.478	20.478	"
	IF PREAMP. ASSY.	A2	1	145.244	145.244	"
	OSCILLATOR ASSY.	A3	1	36.505	36.505	"
	SERVO DRIVE ASSY.	A4	1	55.472	55.472	"
	MAN. TUNE DRIVE ASSY.	A6	1	1.74	1.74	"
	COUPLING ASSY.	A8 & A9	2	NEG.	NEG.	"
				SUMMARY	312.395	MTBF = 3210 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				2 CV-733D	A1 PRESELECTOR		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONDENSER		1	.10	.10	Ns
	CAPACITOR	CM	1	.078	.078	"
	DIODE	1N263	1	17.0	17.0	"
	CONNECTOR, COAX.		3	1.1	3.3	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16				2 CV-733D	A2 IF PREAMP.		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CK	25	.44	11.00	NS
	CAPACITOR	PC	2	.47	.94	"
	COIL, RF		15	.066	.99	"
	RESISTOR	RCR	7	.0077	.054	"
	RESISTOR	RN	2	.03	.060	"
	TUBE, REC.	5842	2	32.5	65.0	"
	TUBE, REC.	5654	2	32.5	65.0	"
	CONNECTOR, COAX.		2	1.1	2.2	"
				SUM OF Nλ	145.244	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM: WLR-16	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 2 CV-733D	ASSEMBLY: A3 OSC.	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CC	1	.44	.44	N_S
	CONDENSER		1	.10	.10	"
	CAPACITOR	CK	3	.44	1.32	"
	CAPACITOR, FIXED PAPER		2	.016	.032	"
	RESISTOR	RCR	3	.0077	.023	"
	TUBE	5718	1	32.5	32.5	"
	CONNECTOR, COAX.		1	1.1	1.1	"
	CAPACITOR, MICA		1	.99	.99	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 2	ASSEMBLY: A4	SUBASSEMBLY:	
WLR-16				CV-733D	SERVO DRIVE		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, CONTROL		1	55.0	55.0	N_s
	GEAR, IDLER		1	.236	.236	"
	GEAR, CLUTCH		1	.236	.236	"
				SUM OF Nλ	55.47	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 2	ASSEMBLY: A6	SUBASSEMBLY:	SHEET 1 OF
WLR-1G	-			CV-733D	MAN. TUNE DRIVE		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	GEAR SHAFT, SPUR		1	1.74	1.74	Ns

SUM OF Nλ: 1.74

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 3	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-734D			

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER, COAXIAL		2	1.1	2.2	NS
	FILTER, BANDPASS		2	.066	.132	"
	CONNECTOR RACK & PANEL		1	.56	.56	"
	RESISTOR	RA	3	8.6	25.8	"
	RESISTOR	RV	1	22.0	22.0	"
	SWITCH, SENSITIVE		2	1.1	2.2	"
	TRANSFORMER, PWR.		1	.064	.064	"
	PRESELECTOR ASSY.	A1	1	21.426	21.426	"
	IF PREAMP. ASSY.	A2	1	145.764	145.764	"
	OSCILLATOR ASSY.	A3	1	37.537	37.537	"
	SERVO DRIVE ASSY.	A4	1	55.472	55.472	"
	MAN. TUNE DRIVE ASSY.	A6	1	1.74	1.74	"
	COUPLING ASSY.	A8 + A9	2	NEG.	NEG.	"
			SUM OF Nλ		[illegible]	MTBF = 3171. HRS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 3	ASSEMBLY: A1	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-734D	PRESELECTOR		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONDENSER		1	.10	.10	NS
	CAPACITOR	PC	2	.47	.94	"
	CAPACITOR	CM	1	.078	.078	"
	DIODE	1N263	1	17.0	17.0	"
	CONNECTOR, COAX.		3	1.1	3.3	"
	RESISTOR	RCR	1	.0077	.0077	"

SUM OF Nλ: 21.42[illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 3	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-734D	IF PREAMP.		

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CK	25	.44	11.0	NS
	CAPACITOR	CB	1	.99	.99	"
	CAPACITOR	PC	1	.47	.47	"
	CONNECTOR, COAX.		2	1.1	2.2	"
	COIL, RF		15	.066	.99	"
	RESISTOR	RCR	7	.0077	.054	"
	RESISTOR	RN	2	.03	.06	"
	TUBE, REC.	5842	2	32.5	65.0	"
	TUBE, REC.	5654	2	32.5	65.0	"

SUM OF Nλ [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM: WLR-1G	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 3 CV-734D	ASSEMBLY: A3 OSC.	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CC	1	.44	.44	NS
	CONDENSER		1	.10	.10	"
	CAPACITOR	CK	3	.44	1.32	"
	CAPACITOR	PC	2	.47	.94	"
	CONNECTOR, COAX.		1	1.1	1.1	"
	COIL, RF		2	.066	.132	"
	RESISTOR	RCR	2	.0077	.015	"
	TUBE	5718	1	32.5	32.5	"
	CAPACITOR, MICA	20pf ±5%, 500VDCW	1	.99	.99	"

SUM OF Nλ 37.537

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 3	ASSEMBLY: A4	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				CV-734D	SERVO DRIVE		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, CONTROL		1	55.0	55.0	NS
	GEAR, IDLER	29T SST, 45T PLASTIC	1	.236	.236	"
	GEAR, CLUTCH	145T	1	.236	.236	"
			SUM OF Nλ		55.472	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 3	ASSEMBLY: A6	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-734D	MAN. TUNE DRIVE		

INDEX NUMBER	DEVICE IDENTIFICATION		QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	NOMENCLATURE	NUMBER				
	SHAFT, GEAR	1ST	1	1.74	1.74	Ns
				SUM OF Nλ	1.7	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
VLR-16				4 CV-735D			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER		1	1.1	1.1	N_S
	FILTER LOWPASS & BANDPASS		2	.066	.132	"
	CONNECTOR RACK & PANEL		1	.56	.56	"
	RESISTOR	RA	3	8.6	25.8	"
	RESISTOR	RV	1	22.0	22.0	"
	SWITCH, SENSITIVE		2	1.1	2.2	"
	SWITCH, PUSH		1	.46	.46	"
	TRANSFORMER		1	.064	.064	"
	PRESELECT-OSC. ASSY.	A1	1	58.483	58.483	"
	IF PREAMP. ASSY.	A2	1	141.386	141.386	"
	SERVO DRIVE ASSY.	A4	1	55.472	55.472	"
	OSC. ARM. ASSY.	A6	1	2.10	2.10	"
	GEAR, SPUR	240 T, ALUMINUM	1	1.74	1.74	"
	SPRING, EXTENSION	SPRING STEEL	3	.02	.06	"
	BALL BEARING		2	.70	1.40	"
	GEAR	188 T	2	.236	.472	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 4	ASSEMBLY: A1	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-735D	PRESEL-OSC.		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	PC	2	.47	.94	NS
	CONNECTOR, COAX.		1	1.1	1.1	"
	COIL, RF		2	.066	.132	"
	CAPACITOR, CER.		3	.44	1.32	"
	CAPACITOR, MICA		1	.99	.99	"
	DIODE	1N263	1	17.0	17.0	"
	COIL, RF		4	.066	.264	"
	CAPACITOR, VAR.		1	.10	.10	"
	CAPACITOR	CK	3	.44	1.32	"
	CAPACITOR, PAPER		2	.016	.032	"
	CHOKE, RF		5	.066	.33	"
	RESISTOR	RCR	2	.0077	.015	"
	TUBE	5675	1	32.5	32.5	"
	GEAR, SPUR		1	1.74	1.74	"
	BEARING, BALL		1	.70	.70	"

SUM OF Nλ: [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				4 CV-735D	A2 IF PREAMP.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CK	17	.44	7.48	N_s
	CAPACITOR	PC	2	.47	.94	"
	CONNECTOR, COAX		2	1.1	2.2	"
	COIL, RF		10	.066	.66	"
	RESISTOR	RCR	6	.0077	.046	"
	RESISTOR	RN	2	.03	.06	"
	TUBE, REC.	5842	2	32.5	65.0	"
	TUBE, REC.	5654	2	32.5	65.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 4	ASSEMBLY: A4	SUBASSEMBLY:	SHEET 1 OF
WLR-18				CV-735D	SERVO DRIVE		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, CONTROL		1	55.0	55.0	NS
	GEAR, IDLER		1	.236	.236	"
	GEAR, CLUTCH	145T	1	.236	.236	"

SUM OF Nλ: 55.47

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 4	ASSEMBLY: A6	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-735D	OSC. ARM		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BEARING, BALL		3	.70	2.10	NS

SUM OF Nλ 2.10

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				5 CV-736D			1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER		1	1.1	1.1	NS
	LAMP		1	1.0	1.0	"
	FILTER		2	.066	.132	"
	CONNECTOR RACK & PANEL		1	.56	.56	"
	CONNECTOR, COAX.		1	1.1	1.1	"
	RESISTOR	RA	1	8.6	8.6	"
	RESISTOR	RV	3	22.0	66.0	"
	RESISTOR	RCR	2	.0077	.015	
	RESISTOR, PRECISION		1	6.1	6.1	"
	SWITCH, SENSITIVE		2	1.1	2.2	"
	SWITCH, TOGGLE		1	.68	.68	"
	SWITCH, PUSH		1	.46	.46	"
	TRANSFORMER, PWR.		1	.064	.064	"
	TUBE, RECT.	OB2	3	65.0	195	"
	DETECTOR ASSY.	A1	1	23.608	23.608	"
	IF AMPLIFIER ASSY.	A2	1	140.726	140.726	"
	OSCILLATOR ASSY.	A3	1	197.54	197.54	"

SUM OF Nλ

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 2 OF
WLR-1G				S CV-736D			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	SERVO DRIVE ASSY.	A4	1	60.692	60.692	NS
	OSCILLATOR ARM ASSY	A6	1	1.40	1.40	"
	BEARING, BALL		2	.70	.70	"
	GEAR	144T	2	.236	.472	"
	SPRING, EXTENSION		3	.02	.06	"
	SUM OF Nλ				[illegible]	MTBF = [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 5	ASSEMBLY: A1	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				CV-736D	PRESELECTOR		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CK	2	.47	.94	NS
	DIODE	1N263	1	17.0	17.0	"
	CONNECTOR, COAX.		2	1.1	2.2	"
	GEAR, SECTOR		1	1.02	1.02	"
	RESISTOR	RCR	1	.0077	.0077	"
	GEAR, SPUR		1	1.74	1.74	"
	BEARING, BALL		1	.70	.70	"
		SUM OF Nλ			23.608	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-16				5 CV-7360	IF AMP.		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CK	18	.44	7.92	NS
	CAPACITOR	PC	2	.47	.94	"
	CONNECTOR, COAX.		1	1.1	1.1	"
	COIL, RF		10	.066	.66	"
	RESISTOR	RCR	6	.0077	.046	"
	RESISTOR	RN	2	.03	.06	"
	TUBE, REC.	5842	2	32.5	65.0	"
	TUBE, REC.	5654	2	32.5	65.0	"
			SUM OF Nλ		140.72	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				5 CV-736D	A3 OSCILLATOR		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	$N\lambda$	REMARKS
	CAPACITOR	CK	1	.44	.44	N_S
	BEARING, BALL		3	.70	2.10	"
	TUBE	6BM6, KLYSTRON	1	195	195	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF.
WLR-1G				5 CV-736D	A4 SERVO DRIVE		

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, CONTROL		1	55.0	55.00	NS
	GEAR, SHAFT	15 T	1	.236	.236	"
	GEAR, IDLER		1	.236	.236	"
	GEAR, SPUR	145 T	3	1.74	5.22	"

SUM OF Nλ [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				5 CV-736D	A6 OSC. AR M		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BEARING, BALL		2	.70	1.40	Ns

SUM OF Nλ: 1.40

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16				6 CV-1159A			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY.)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ATTN. COAX.	RD	1	1.5	1.5	N_s APPROX. 100KΩ, ½
	CONNECTOR RACK & PANEL	4 CONTACTS -15A 500V 16 CONTACTS - 5A RMS	1	.56	.56	"
	METER, ELAP. TIME	3W 115V 60 HZ	1	10.0	10.0	"
	RESISTOR NON-WW PRECISION	3W 13.7K ±3% 105V (1) RV4LAYSA252A (2)	3	22.0	66.0	"
	SWITCH, TOGGLE	2 POS. 220VAC 9 AMP.	1	.68	.68	"
	TRANSFORMER, PWR.	PRI. 109V-131V 47-63 HZ SEC. 16V .35ARMS + 6V .2A RMS	1	.064	.064	"
	PRESELECTOR ASSY	A2	1	3.70	3.70	"
	MIXER ASSY.	A3	1	89.0	89.0	" ONE UNIT, NO PAR-
	OSCILLATOR ASSY.	A4	1	30.412	30.412	"
	POWER SUPPLY ASSY.	A5	1	32.341	32.341	"
	GEAR DRIVE ASSY.	A6	1	59.132	59.132	"
	IF AMP. ASSY.	A7	1	48.871	48.871	"
	FRONT PANEL ASSY.	A8	1	NEG.	NEG.	"
	PRESEL. CAM ASSY.	A10	1	8.80	8.80	"
	OSC. CAM ASSY.	A11	1	12.0	12.0	"
	GEAR, SPUR		2	1.74	3.48	"

SUM OF Nλ [illegible] MTBF = [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				6 CV-1159A	A2 PRESELECTOR		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER ASSY, COAX,		2	1.1	2.2	Ns
	BEARING, BALL		2	.70	1.4	"
	TUNED CAVITY		1	.10	.10	"

SUM OF Nλ 3.70

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 6	ASSEMBLY: A4	SUBASSEMBLY:	
WLR-16				CV-1159A	OSCILLATOR		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION		QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	NOMENCLATURE	NUMBER				
	OSCILLATOR, MICROWAVE	2000 MHZ 12,3 VDC TEXSCAN CORP. MTO-101	1	27.412	27,412	N_S
	BUSHING, BEARING		4	.40	1,60	"
	BEARING, BALL		2	.70	1,40	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-18				6 CV-1159A	A5 POWER SUPPLY		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, ELECTRO.	CLR CLR25BH251T6P (1) CLR25BH180T6P (2)	3	.033	.099	N_S
	CAPACITOR	CKR CKR06BX103KP (2)	2	.0132	.026	"
	DIODE, SILICON	1N3189	8	.75	6.0	" 200V ½ AMP,
	RESISTOR, VAR.	RJ MIL-R-22097 RJ50 35V 5K±20% (2)	2	13.0	26.0	"
	REGULATOR, DC VOLT.	INPUT 40V, OUTPUT 5-40V 4W PWR DISS. TO-3	2	.103	.206	"
	P.C. BOARD	EPOXY GLASS	2	.0048	.010	"
				SUM OF Nλ	32.341	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:
WLR-1G				6 CV-1159A	A6 GEAR DRIVE	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, SERVO	2 PH. 115VAC 60HZ. 3400W 2.5W CONT. DUTY	1	55.0	55.0	N_S
	SWITCH, SENSITIVE	SPDT, 28VDC 4 AMP. MOM. ACTION	1	1.1	1.1	"
	GEAR, BEVEL, PINION		2	.236	.472	"
	GEARHEAD, PRECISION	27:1 RATIO SST	1	1.86	1.86	"
	BEARING, BALL		1	.70	.70	"
				SUM OF Nλ	59.132	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				6 CV-1159A	A7 PREAMP.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, VAR. GLASS	1.0 - 10.0 PF 1000VDC @ 1MHZ (5)	5	2.7	13.50	NS
	CAPACITOR	CKLOAW102M (9) CK	9	.44	3.96	"
	CAPACITOR, CERAMIC FIXED	FEEDTHRU 470MMF ±20% 500VDC (4)	4	.44	1.76	"
	CAPACITOR, MICA	CM05C100K03 (3) CM05C050K03 (1)	4	.078	.312	"
	CAPACITOR, GLASS FIXED	1.0MMF 0.25MMF TOL. (4) 500V DC 2.2MMF (1)	5	.25	1.25	" CY
	CAPACITOR FIXED, CER.	DIELECSTANDOFF 470MMF ±20% 500VDC (7)	7	.44	3.08	"
	CONNECTOR, COAX.	UG-477/U UG-535/U	2	1.1	2.2	"
	COIL, RF	CERAMIC SLUG TUNED	4	.066	.264	"
	CHOKE, RF MOLDED	150MH (4) .68MH (2) .22MH (1)	7	.066	.462	"
	TRANSISTOR, GER. PNP	2N2997	3	3.5	10.5	"
	TRANSISTOR, GER. PNP	2N2996	3	3.5	10.5	"
	RESISTOR	RC07GF472K (10) RC07GF122K (5) RC07GF271K (1) RC	21	.039	.819	"
	———	RC07GF562K (1) RC07GF222K (1) RC07GF470K (3)	—	—	—	"
	RF TRANSFORMER ASSY.		3	.066	.198	"
	RESONATOR, HELICAL		1	.066	.066	"

18.97[illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				6 CV-1159A	A10 PRESEL. CAM		SHEET 1 OF .

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		22	.40	8.80	Ns
				SUM OF Nλ	8.80	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 6	ASSEMBLY: A11	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1159A	OSC. CAM		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		30	.40	12.0	Ns
			SUM OF Nλ		12.0	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				7 CV-1160A			1

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ATTN. COAX.	RD	1	1.5	1.5	N_S APPROX. 100KΩ, ½
	CONNECTOR RACK + PANEL	4 CONTACTS -15A 500V; 16 CONTACTS - 5A RMS	1	.56	.56	"
	METER, ELAP. TIME	3W 115V 60 HZ	1	10.0	10.0	"
	RESISTOR NON-WW PRECISION	3W 13.7K ±3% 105V (1); RV4LAYSA252A (2)	3	22.0	66.0	"
	SWITCH, TOGGLE	2 POS. 220VAC 9 AMP.	1	.68	.68	"
	TRANSFORMER, PWR.	PRI. 109V-131V 47-63 HZ; SEC. 15V .35A RMS + 6V .2A RMS	1	.064	.064	"
	PRESELECTOR ASSY	A2	1	3.70	3.70	"
	MIXER ASSY.	A3	1	89.0	89.0	" ONE UNIT, NO PA[illegible]
	OSCILLATOR ASSY.	A4	1	30.412	30.412	"
	POWER SUPPLY ASSY.	A5	1	32.341	32.341	"
	GEAR DRIVE ASSY.	A6	1	59.132	59.132	"
	PREAMP. ASSY.	A7	1	48.871	48.871	"
	FRONT PANEL ASSY.	A8	1	NEG.	NEG.	"
	PRESEL. CAM ASSY.	A10	1	12.8	12.8	"
	OSC. CAM ASSY.	A11	1	12.0	12.0	"
	GEAR, SPUR		2	1.74	3.48	"
			SUM OF	Nλ's =	370.540	MTBF = 2699 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				7 CV-1160A	A2 PRESELECTOR		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER ASSY, COAX.		2	1.1	2.2	N_s
	BEARING, BALL		2	.70	1.4	"
	TUNED CAVITY		1	.10	.10	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				7 CV-1160 A	A 4 OSCILLATOR		1

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	$N\lambda$	REMARKS
	OSCILLATOR, MICROWAVE	2975-4850 MHz 12.3VDC 15mW (MIN.) MTO-102	1	27.412	27.412	NS TEXSCAN CORP.
	BUSHING, BEARING		4	.40	1.60	"
	BEARING, BALL		2	.70	1.40	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 7	ASSEMBLY: A5	SUBASSEMBLY:	SHEET 1
WLR-18				CV-1160A	POWER SUPPLY		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, ELECTRO.	CLR CLR25BH251T6P (1) CLR25BH180T6P (2)	3	.033	.099	N_S
	CAPACITOR	CKR CKR06BX103KP (2)	2	.0132	.0264	"
	DIODE, SILICON	1N3189	8	.75	6.0	" 200V ½ AMP.
	RESISTOR, VAR.	RJ MIL-R-22097 RJ50 35V 5K±20%. (2)	2	13.0	26.0	"
	REGULATOR, DC VOLT.	INPUT 40V, OUTPUT 5-40V 4W PWR DISS. TO-3	2	.103	.206	"
	P.C. BOARD	EPOXY GLASS	2	.0048	.010	"
			SUM OF Nλ's =		32.341	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				7 CV-1160 A	A6 GEAR DRIVE		1

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, SERVO	2 PH. 115VAC 60HZ. 3400W 2.5W CONT. DUTY	1	55.0	55.0	N_S
	SWITCH, SENSITIVE	SPDT, 28VDC 4 AMP. MOM. ACTION	1	1.1	1.1	"
	GEAR, BEVEL, PINION		2	.236	.472	"
	GEARHEAD, PRECISION	27=1 RATIO SST	1	1.86	1.86	"
	BEARING, BALL		1	.70	.70	"
			SUM OF Nλ's		59.132	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 7	ASSEMBLY: A7	SUBASSEMBLY:	SHEET 1
WLR-16				CV-1160A	PREAMP.		

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, GLASS VAR.	1.0 - 10.0 PF 1000VDC @ 1MHz (5)	5	2.7	13.50	N_S
	CAPACITOR	CK60AW102M (9) CK	9	.44	3.96	"
	CAPACITOR, FIXED CERAMIC	FEEDTHRU 470mmf ±20% 500VDC (4)	4	.44	1.76	"
	CAPACITOR, MICA	CM05C100K03 (3) CM05C050K03 (1)	4	.078	.312	"
	CAPACITOR, FIXED GLASS	1.0mmf 0.25mmf TOL. (4) 500V DC 2.2mmf (1)	5	.250	1.25	" CY
	CAPACITOR FIXED, CER.	DIELEC STANDOFF 470mmf ±20% 500VDC (7)	7	.44	3.08	"
	CONNECTOR, COAX.	UG-477/U UG-535/U	2	1.1	2.2	"
	COIL RF	CERAMIC SLUG TUNED	4	.066	.264	"
	CHOKE, RF MOLDED	150mh (4) .68mh (2) .22mh (1)	7	.066	.462	"
	TRANSISTOR, PNP GER.	2N2997	3	3.5	10.5	"
	TRANSISTOR, PNP GER.	2N2996	3	3.5	10.5	"
	RESISTOR	RC07GF472K (10) RC07GF122K (5) RC07GF271K (1) RC	21	.039	.819	"
	—	RC07GF562K (1) RC07GF222K (1) RC07GF470K (3)	—	—		"
	RF TRANSFORMER ASSY.		3	.066	.198	"
	RESONATOR, HELICAL		1	.066	.066	"
			SUM OF	Nλ's	48.871	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 7	ASSEMBLY: A10	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1160A	PRESEL. CAM		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		32	.40	12.80	NS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				7 CN-1160A	A11 OSC. CAM		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	$N\lambda$	REMARKS
	BUSHING, ECCENTRIC		30	.40	12.0	Ns

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				8 CV-1161A			1

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY.)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ATTN. COAX.	RD	1	1.5	1.5	N_S APPROX. 100kΩ, ½
	CONNECTOR RACK & PANEL	4 CONTACTS - 15A 500V RMS 16 CONTACTS - 5A	1	.56	.56	"
	METER, ELAP. TIME	3W 115V 60 HZ	1	10.0	10.0	"
	RESISTOR NON-WW PRECISION	3W 13.7K ±3% 105V (1) RV4LAYSA252A (2)	3	22.0	66.0	"
	SWITCH, TOGGLE	2 POS. 220VAC 9 AMP.	1	.68	.68	"
	TRANSFORMER, PWR.	PRI. 109V-131V 47-63 HZ SEC. 16V .35ARMS & 6V .2A RMS	1	.064	.064	"
	PRESELECTOR ASSY	A2	1	3.70	3.70	"
	MIXER ASSY.	A3	1	89.0	89.0	" ONE UNIT, NO PA[illegible]
	OSCILLATOR ASSY.	A4	1	5.21	5.21	"
	POWER SUPPLY ASSY.	A5	1	30.436	30.436	"
	GEAR DRIVE ASSY.	A6	1	59.132	59.132	"
	PREAMP. ASSY.	A7	1	48.871	48.871	"
	FRONT PANEL ASSY.	A8	1	NEG.	NEG.	"
	PRESEL. CAM ASSY.	A10	1	14.0	14.0	"
	OSC. CAM ASSY.	A11	1	11.60	11.60	"
	CAPACITOR, ELECTRO	1000mf 50V CU	1	1.9	1.9	"
	GEAR, SPUR		2	1.74	3.48	" MTBF = 2889 HR

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 8	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1161A	PRESELECTOR		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER ASSY., COAX.		2	1.1	2.2	NS
	BEARING, BALL		2	.70	1.4	"
	TUNED CAVITY		1	.10	.10	"

SUM OF Nλ: [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				8 CV-1161A	A4 OSCILLATOR		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED ELECTRO.	CLR25BH180TBP	1	.11	.11	NS
	OSCILLATOR, MICROWAVE	4800-7700 GHz 12.3VDC 15mW S476Y1 (RCA)	1	2.10	2.10	"
	BUSHING, BEARING		4	.40	1.60	"
	BEARING, BALL		2	.70	1.40	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				8 CV-1161A	A5 POWER SUPPLY		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, ELECTRO.	CLR CLR25BH231TEP (1) CLR25BH180TGP (2)	3	.033	.099	N_S
	CAPACITOR	CKR CKR06BX103KP	2	.0132	.0264	"
	DIODE, SILICON	1N3189	4	.75	3.0	" 200V : 1/2 Amp
	RESISTOR, VAR.	RJ MIL-R-22097 RJ50 35V 5K ±20%	2	13.0	26.0	"
	REGULATOR, DC VOLT.	INPUT 40V, OUTPUT 5-40V 4W PWR. DISS. TO-3	2	.103	.206	"
	TRANSISTOR SILICON NPN PWR	MIL TYPE 2N3584	1	1.1	1.1	"
	P.C. BOARD	EPOXY GLASS	1	.0048	.0048	"

SUM OF Nλ 30.4[illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				8 CV-1161A	A6 GEAR DRIVE		1

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, SERVO	2 PH. 115VAC 60HZ. 3400W 2.5W CONT. DUTY	1	55.0	55.0	N_S
	SWITCH, SENSITIVE	SPDT, 28VDC 4 AMP. MOM. ACTION	1	1.1	1.1	"
	GEAR, BEVEL, PINION		2	.236	.472	"
	GEARHEAD, PRECISION	27=1 RATIO SST	1	1.86	1.86	"
	BEARING, BALL		1	.70	.70	"
			SUM OF	Nλ's	59.132	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				8 CV-1161A	A7 PREAMP.		1

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, GLASS VAR.	1.0 – 10.0 PF 1000VDC @ 1MHz (5)	5	2.7	13.50	Ns
	CAPACITOR	CK60AW102M (9) CK	9	.44	3.96	"
	CAPACITOR, FIXED CERAMIC	FEEDTHRU 470mmf ±20% 500VDC (4)	4	.44	1.76	"
	CAPACITOR, MICA	CM05C100K03 (3) CM05C050K03 (1)	4	.078	.312	"
	CAPACITOR, FIXED GLASS	1.0mmf 0.25mmf TOL. (4) 500V DC 2.2mmf (1)	5	.250	1.25	" CY
	CAPACITOR FIXED, CER.	DIELECSTANDOFF 470mmf ±20% 500VDC (7)	7	.44	3.08	"
	CONNECTOR, COAX.	UG-477/U UG-535/U	2	1.1	2.2	"
	COIL, RF	CERAMIC SLUG TUNED	4	.066	.264	"
	CHOKE, RF MOLDED	150mh (4) .68mh (2) .22mh (1)	7	.066	.462	"
	TRANSISTOR, PNP GER.	2N2997	3	3.5	10.5	"
	TRANSISTOR, PNP GER.	2N2996	3	3.5	10.5	"
	RESISTOR	RC07GF472K (10) RC07GF122K (5) RC07GF271K (1) RC	21	.039	.819	"
	———	RC07GF562K (1) RC07GF222K (1) RC07GF470K (3)	—	—		"
	RF TRANSFORMER ASSY.		3	.066	.198	"
	RESONATOR, HELICAL		1	.066	.066	"
			SUM OF	Nλ's	48.871	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				8 CV-1161A	A10 PRESEL. CAM		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		35	.40	14.00	Ns

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 8	ASSEMBLY: A11	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1161A	OSC. CAM		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		29	.40	11.60	NS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				9 CV-1162A			1

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ATTN. COAX.	RD	1	1.5	1.5	N_S APPROX. 100KΩ, ½
	CONNECTOR RACK & PANEL	4 CONTACTS -15A 500V RMS 16 CONTACTS -5A	1	.56	.56	"
	METER, ELAP. TIME	3W 115V 60 HZ	1	10.0	10.0	"
	RESISTOR NON-WW PRECISION	3W 13.7K ±3% 105V (1) RV4LAYSA252A (2)	3	22.0	66.0	"
	SWITCH, TOGGLE	2 POS. 220VAC 9 AMP.	1	.68	.68	"
	TRANSFORMER, PWR.	PRI. 109V-131V 47-63 HZ SEC. 16V .35A RMS & 6V .2A RMS	1	.064	.064	"
	PRESELECTOR ASSY	A2	1	3.70	3.70	"
	MIXER ASSY.	A3	1	89.0	89.0	" ONE UNIT, NO PA[illegible]
	OSCILLATOR ASSY.	A4	1	5.61	5.61	"
	POWER SUPPLY ASSY.	A5	1	30.436	30.436	"
	GEAR DRIVE ASSY.	A6	1	59.132	59.132	"
	PREAMP. ASSY.	A7	1	48.871	48.871	"
	FRONT PANEL ASSY.	A8	1	NEG.	NEG.	"
	PRESEL. CAM ASSY.	A10	1	14.40	14.40	"
	OSC. CAM ASSY.	A11	1	11.60	11.60	"
	CAPACITOR, ELECTRO.	1000mf 50V	1	1.9	1.9	"
	GEAR, SPUR		2	1.74	3.48	" MTBF = 2882 HRS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 9	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1162A	PRESELECTOR		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	ADAPTER ASSY, COAX,		2	1.1	2.2	NS
	BEARING, BALL		2	.70	1.4	"
	TUNED CAVITY		1	.10	.10	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 9	ASSEMBLY: A4	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1162A	OSCILLATOR		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED ELECTRO.	CLR25BH180TGP	1	.11	.11	Ns
	OSCILLATOR, MICROWAVE	7.70 – 11.20 GHz 12.3VDC 15mw GT101	1	2.10	2.10	" TEXSCAN CORP.
	BUSHING, BEARING		5	.40	2.0	"
	BEARING, BALL		2	.70	1.40	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-?G				9 CV-1162A	A5 POWER SUPPLY		1

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, ELECTRO.	CLR CLR 25 BH 231 TGP (1) CLR 25 BH 180 TGP (2)	3	.033	.099	N_S
	CAPACITOR	CKR CKR06BX103KP	2	.0132	.0264	"
	DIODE, SILICON	1N3189	4	.75	3.0	" 200V 1/2 AMP
	RESISTOR, VAR.	RJ MIL-R-22097 RJ50 35V 5K ±20%	2	13.0	26.0	"
	REGULATOR, DC VOLT.	INPUT 40V, OUTPUT 5-40V 4W PWR. DISS. TO-3	2		.206	"
	TRANSISTOR SILICON NPN PWR	MIL TYPE 2N3584	1	1.1	1.1	"
	P.C. BOARD	EPOXY GLASS	1	.0048	.0048	"
			SUM OF Nλ =		30.436	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
ULR-16				9 CV-1162A	A6 GEAR DRIVE		1

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	$N\lambda$	REMARKS
	MOTOR, SERVO	2 PH. 115VAC 60HZ. 3400W 2.5W CONT. DUTY	1	55.0	55.0	N_S
	SWITCH, SENSITIVE	SPDT, 28VDC 4 AMP. MOM. ACTION	1	1.1	1.1	"
	GEAR, BEVEL, PINION		2	.236	.472	"
	GEARHEAD, PRECISION	27=1 RATIO SST	1	1.86	1.86	"
	BEARING, BALL		1	.70	.70	"
			SUM OF $N\lambda$'s		59.132	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 9	ASSEMBLY: A7	SUBASSEMBLY:	SHEET 1
WLR-16				CV-1162A	PREAMP.		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, GLASS VAR.	1.0 - 10.0 PF 1000VDC @ 1MHz (5)	5	2.7	13.50	NS
	CAPACITOR	CKL0AW102M (9) CK	9	.44	3.96	"
	CAPACITOR, FIXED CERAMIC	FEEDTHRU 470MMF ±20% 500VDC (4)	4	.44	1.76	"
	CAPACITOR, MICA	CM05C100K03 (3) CM05C050K03 (1)	4	.078	.312	"
	CAPACITOR, FIXED GLASS	1.0MMF 0.25MMF TOL. (4) 500V DC 2.2MMF (1)	5	.250	1.25	" CY
	CAPACITOR FIXED, CER.	DIELEC STANDOFF 470MMF ±20% 500VDC (7)	7	.44	3.08	"
	CONNECTOR, COAX.	UG-477/U UG-535/U	2	1.1	2.2	"
	COIL, RF	CERAMIC SLUG TUNED	4	.066	.264	"
	CHOKE, RF MOLDED	150MH (4) .68MH (2) .22MH (1)	7	.066	.462	"
	TRANSISTOR, PNP GER.	2N2997	3	3.5	10.5	"
	TRANSISTOR, PNP GER.	2N2996	3	3.5	10.5	"
	RESISTOR	RC07GF472K (10) RC07GF122K (5) RC07GF221K (1) RC	21	.039	.819	"
	—	RC07GF562K (1) RC07GF222K (1) RC07GF470K (3)	—	—		"
	RF TRANSFORMER ASSY.		3	.066	.198	"
	RESONATOR, HELICAL		1	.066	.066	"
			SUM	OF Nλ's	48.871	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 9	ASSEMBLY: A10	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1162A	PRESEL. CAM		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		36	.40	14.40	Ns

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 9	ASSEMBLY: A11	SUBASSEMBLY:	SHEET 1 OF
WLR-16				CV-1162A	OSC. CAM		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	BUSHING, ECCENTRIC		29	.40	11.60	NS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				10 CV-741 FREQ. CONV.			1 OF

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CC30UJ750J (2) CC20CH100C (1) CC30RH390F (1)	4	.44	1.76	Ns
	CAPACITOR, FIXED MICA	1000pf ±20% 500VDC (4) CB11PE102M (3)	7	.99	6.93	"
	CAPACITOR, FIXED CERM.	CK60AW102M (13) CK70AW102M (2)	15	.44	6.6	"
	CAPACITOR, FIXED PAPER	CP11A3KB105K (1) CP11A3KE104K (4)	5	.016	.080	"
	DIODE, SILICON	JAN 1N458	1	.75	.75	"
	DIODE, SILICON	JAN 1N251	2	.75	1.50	"
	CONNECTOR RACK & PANEL	4 CONT. 750VDC 15A (1) 16 CONT. 900VAC 5A	2	.56	1.12	"
		15 CONT. 490VDC 5A (1)	—		—	"
	CONNECTOR, COAX.	UG-1094/U	2	1.1	2.2	"
	RELAY, GEN. PUR.	4PDT, 280Ω 27.5VDC	1	1.6	1.6	"
	COIL, RF	STEATITE FORM W/ADJ. CORE	2	.066	.132	"
	CHOKE, RF, MOLDED	MS75008-33 (2) MS75008-41 (2) MS75008-37 (1)	8	.066	.528	"
	———	MS75008-36 (1) MS91189-37 (1) MS75055-2 (1)	—	—	—	"
	CHOKE, RF	.25uh 0.05Ω 1.5A	2	.066	.132	"
	RESISTOR, FIXED COMP.	RCR20G271KM (2) RCR20G332KM (2) RCR20G104JM (2)	23	.0077	.177	"
	———	RCR20G470JM (2) RCR20G103JM (1) RCR20G121KM (1)	—	—	—	"
	———	RCR20G472JM (1) RCR20G123JM (1) RCR20G152KM (1)	—	—	—	"

SUM OF Nλ

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				10 CV-741 FREQ. CONV.			2

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RCR 20G 154 KM (1) RCR 20G 183 KM (1) RCR 20G 101 KM (3)	—	—	—	Ns
	—	RCR 20G 102 KM (1) RCR 20G 222 KM (1) RCR 20G 224 JM (1)	—	—	—	"
	—	RCR 20G 471 KM (1) RCR 20G 105 KM (1)	—	—	—	"
	RESISTOR, FIXED FILM	RN65B6813F (1) RN65B3480F (1) RN75B5112F (2)	4	.03	.12	"
	RESISTOR,	RV4NAYSD502A (1) RV4NAYSD102A (1) RV4LAYSA252B (1)	3	22.0	66.0	"
	TRANSFORMER, IF	11.0 MHZ INTERSTAGE SLUG TUNED	2	.066	.132	"
	TRANSFORMER, PWR.	PRI. 115V 57/63 HZ SEC. 6.3V @ 5.0A SEC. 6.3V @ 2.5A	1	.064	.064	"
	TUBE, REC.	5654	2	32.5	65.0	"
	TUBE, REC.	5670	1	32.5	32.5	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"
	TUBE, REC.	5687WA	1	32.5	32.5	"
	IF AMP. ASSY.	A1	1	403.822	403.822	"
	OSCILLATOR – MIXER	A2	1	332.780	332.780	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				10 CV-741 FREQ. CONV.	A1 IF AMP.		1 OF

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK60AW102M (4) 2000pf 500VDC (9) CK70AW102M (5)	28	.44	12.32	NS
	CAPACITOR, FIXED MICA	CM15E820G (1)	1	.078	.078	"
	CAPACITOR, FIXED CERM.	CC20CJ030C (1) CC20CH120J (1) CC30CH270F (1)	12	.44	5.28	"
	—	CC20CH050D (1) CC20UJ100D (1) CC30UJ620J (7)	—	—	—	"
	CAPACITOR, FIXED MICA	CB21PD102K (16) CB11PE102M (1) CB21PD102M (1)	18	.99	17.82	"
	CAPACITOR, VAR. CERM.	8-50pf 350VDC W	2	2.7	5.4	"
	CONNECTOR, COAX.	UG-1094/U	2	1.1	2.2	"
	COIL, RF	STEATITE FORM W/ADJ. SLUG	2	.066	.132	"
	CHOKE, R.F. MOLDED	MS75008-38 (1) MS75008-21 (3) MS75008-33 (11)	19	.066	1.254	"
	—	MS75008-41 (4)	—	—	—	"
	CHOKE, R.F	.25mh 0.05Ω 1.5A (2)	2	.066	.132	"
	COIL, RF	2uh 0.072Ω 110ma (3) 1.25uh 0.072Ω 110ma (3)	6	.066	.396	"
	CONNECTOR RACK & PANEL	15 CONT. 490VDC @ 5A	1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G103KM (1) RCR20G331KM (2) RCR20G121KM (1)	20	.0077	.154	"
	—	RCR20G151KM (1) RCR20G221JM (1) RCR20G182JM (1)	—	—	—	"
	—	RCR20G562JM (1) RCR20G232JM (1) RCR20G101KM (1)	—	—	—	"
	—	RCR20G101JM (6) RCR20G151JM (4)	—	—	—	"

SUM OF Nλ

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 10 CV-741 FREQ. CONV.	ASSEMBLY: A1 IF AMP.	SUBASSEMBLY:	SHEET 2 OF
WLR-16							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESISTOR, FIXED FILM	RN65B51R1F (2) RN65B6800F (1) RN65B3160F (1)	11	.03	.33	NS
	——	RN65B1211F (1) RN65B2151F (3) RN65B1470F (1)	—	—	—	"
	——	RN65B1781F (2)	—	—	—	"
	TRANSFORMER ASSY.	IF, 60MHZ INTERSTAGE	1	.066	.066	"
	TUBE, REC.	5670	2	32.5	65.0	"
	TUBE, REC.	5654	7	32.5	227.5	"
	TUBE, REC.	5726/6AL5W	1	32.5	32.5	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"
	CRYSTAL UNIT	QUARTZ 23.000 MHZ 0.002% SERIES RESN.	1	0.2	0.2	"

SUM OF Nλ [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/21/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				10 CV-741 FREQ. CONV.	A2 OSC. MIXER		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED, CERM.	CK70AW102M (10) CK60AW102M (6)	16	.44	7.04	N_S
	CAPACITOR, FIXED, CERM.	CC30UJ620J (3) CC30UJ101J (2) CC20UJ300J (2)	10	.44	4.4	"
	—	CC30UJ820J (1) CC30CH180J (1) CC20CH050C (1)	—	—	—	"
	CAPACITOR, FIXED MICA	CB21PD101J (1) 1000PF ±20% 500VDC (2)	3	.99	2.97	"
	CAPACITOR, FIXED PAPER	CPV09A1KE104KM (2)	2	.0016	.003	"
	CAPACITOR, FIXED CERM.	CC20UJ100D (1)	1	.44	.44	"
	CAPACITOR, FIXED PAPER	CP11A3KE104K (1)	1	.16	.16	"
	CONNECTOR, COAX.	UG-1094/U	1	1.1	1.1	"
	CHOKE, RF	.25mh 0.05Ω 1.5A (8)	8	.066	.528	"
	COIL, RF, MOLDED	MS75008-41	1	.066	.066	"
	COIL, RF	FORM W/ADJ CORE	6	.066	.396	"
	RESISTOR	RCR20G563JM (2) RCR20G155KM (1)	23	.0077	.177	"
	—	RCR20G471JM (1) RCR20G561JS (1)	—	—	—	"
	—	RCR20G564JM (2) RCR20G222JM (1)	—	—	—	"
	—	RCR20G151JM (1) RCR20G473JM (1)	—	—	—	"
	—	RCR20G152JM (1) RCR20G822JM (1)	—	—	—	"
	—	RCR20G153JM (1) RCR20G121JM (1)	—	—	—	"

SUM OF Nλ

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/73

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 10 CV-741 FREQ. CONV.	ASSEMBLY: A2 OSC. MIXER	SUBASSEMBLY:	SHEET 2 OF
WLR-16							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RCR20G222JM (1) RCR20G391KM (1)	—	—	—	NS
	—	RCR20G470KM (1) RCR20G472JM (1)	—	—	—	"
	—	RCR20G101KM (1) RCR20G102KM (1)	—	—	—	"
	—	RCR20G471KM (1) RCR20G154KM (1)	—	—	—	"
	—	RCR20G224KM (1)	—	—	—	"
	RESISTOR, VAR. COMP.	RV4LAYSA502B (1) RV4LAYSA103B (1)	4	22.0	88.0	"
	—	RV4LAYSA105B (1) RV4LAYSA252B (1)	—	—	—	"
	TUBE, REC.	6C4WA	1	32.5	32.5	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"
	TUBE, REC.	8113	1	32.5	32.5	"
	TUBE, REC.	5727/2D21W	1	32.5	32.5	"
	TUBE, REC.	5814A	1	32.5	32.5	"
	TUBE, REC.	5670	2	32.5	65.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-1G				11 CV-742D FREQ. CONV.			SHEET 1 OF

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED MICA	100pf ±20% 500VDC (2) 1000pf ±20% 500VDC (2)	4	.99	3.96	N_S
	CAPACITOR, FIXED CERM.	CK60AW102M (13) CK70AW102M (2)	15	.44	6.60	"
	CAPACITOR, FIXED CERM.	CC30UJ620J (2) CC20RH100C (1) CC20CH100C (1)	6	.44	2.64	"
	—	CC20CH050D (1) CC30UJ101J (1)	—	—	—	"
	CAPACITOR, FIXED PAPER	CP11A3KE104K (4) CP11A3K473K (1) CP11A3KB105K (1)	6	.016	.096	"
	CAPACITOR, FIXED MICA	CM15C470J (1)	1	.078	.078	"
	CAPACITOR, FIXED MICA	CB11PE102M (3)	3	.99	2.97	"
	DIODE	JAN 1N251	2	.75	1.50	"
	DIODE	JAN 1N458	1	.75	.75	"
	CONNECTOR RACK + PANEL	4 CONT. 750VDC 15A 16 CONT. 900VAC 5A (1)	2	.56	1.12	"
	—	15 CONT. 490VDC 5A (1)	—	—	—	"
	CONNECTOR, COAX.	UG-1094/U	2	1.1	2.2	"
	RELAY, GEN. PUR.	4PDT, 280Ω 27.5VDC	1	1.6	1.6	"
	COIL, RF, MOLDED	MS75008-33 (7) MS75008-28 (1)	9	.066	.594	"
	—	MS75008-41 (1)	—	—	—	"
	COIL RF	.25uh 0.05Ω 1.5A (2) 2.0mh 35mA 3π SEC. (1)	3	.066	.198	"
	RESISTOR, FIXED COMP.	RCR20G271KM (2) RCR20G332KM (2)	22	.0077	.169	"

SUM OF Nλ

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 11 CV-742D FREQ. CONV.	ASSEMBLY:	SUBASSEMBLY:	SHEET 2 OF
WLR-10							

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RCR 20G100JM (2) RCR 20G104JM (1)	—	—	—	N_s
	—	RCR 20G470JM (1) RCR 20G103JM (1)	—	—	—	"
	—	RCR 20G151KM (1) RCR 20G472JM (1)	—	—	—	"
	—	RCR 20G183JM (1) RCR 20G152KM (1)	—	—	—	"
	—	RCR 20G103KM (1) RCR 20G101KM (2)	—	—	—	"
	—	RCR 20G154KM (1) RCR 20G102KM (1)	—	—	—	"
	—	RCR 20G222KM (1) RCR 20G224JM (1)	—	—	—	"
	—	RCR 20G105KM (1) RCR 20G470KM (1)	—	—	—	"
	RESISTOR, VAR. [illegible]	RV4NAYSD502A (1) RV4NAYSD102A (1)	3	2.0	66.0	"
	—	RV4NAYSA252B (1)	—	—	—	"
	RESISTOR, FIXED FILM	RN 65B1003F (1) RN 65B6813F (1)	5	.03	.150	"
	—	RN 65B3480F (1) RN 75B5112F (2)	—	—	—	"
	TRANSFORMER, IF	39.0 MHZ, SLUG TUNED	2	.066	.132	"
	TRANSFORMER, PWR.	PRI. 115V 57/63 HZ SEC. 6.3V @ 5.0A SEC. 6.3V @ 2.5A	1	.064	.064	"
	TUBE, REC.	5654	2	32.5	65.0	"
	TUBE, REC.	5670	1	32.5	32.5	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"

SUM OF Nλ —

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				11 CV-742D FREQ. CONV.			3 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	TUBE, REC.	5687WA	1	32.5	32.5	Ns
	IF AMP. ASSY.	A1	1	406.09	406.09	"
	OSC.-MIXER ASSY.	A2	1	452.738	452.738	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				11 CV-742D FREQ. CONV.	A1 IF AMP.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR FIXED MICA	CB11RD102M (11) CB21PD102K (2) 1000PF 500VDC (9)	22	.99	21.78	NS
	CAPACITOR, FIXED CERM.	CK60AW102M (1) CK60AW331M (29)	35	.44	15.40	"
	—	CK70AW102M (5)	—	—	—	"
	CAPACITOR, FIXED CERM.	CC30UJ750G (4) CC20UJ510J (9)	14	.44	6.16	"
	—	CC20UK020C (1)	—	—	—	"
	CAPACITOR, FIXED PAPER	CPV09A1KF103KM	1	.0016	.0016	"
	CONNECTOR, COAX.	UG-290A/U	2	1.1	2.2	"
	CHOKE, RF	0.25μh 0.05Ω 1.5A (12)	12	.066	.792	"
	COIL, R.F. MOLDED	MS75008-33 (14) MS75008-23 (1)	19	.066	1.254	"
	—	MS75008-41 (4)	—	—	—	"
	CONNECTOR RACK + PANEL		1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G510JM (1) RCR20G820JM (4)	23	.0077	.177	"
	—	RCR20G100JM (9) RCR20G101JM (4)	—	—	—	"
	—	RCR20G201JM (1) RCR20G151JM (1)	—	—	—	"
	—	RCR20G102KM (1) RCR20G101KM (1)	—	—	—	"
	—	RCR20G332KM (1)	—	—	—	"
	RESISTOR, FIXED FILM	RN65B3481F (3) RN65B2371F (3)	9	.03	.270	"

SUM OF Nλ:

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 11	ASSEMBLY: A1	SUBASSEMBLY:	SHEET 2 OF
WLR-1G				CV-742D FREQ. CONV.	IF AMP.		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	———	RN65B1001F (2) RN65B1471F (1)	—	—	—	Ns
	TUBE, REC.	5654	9	32.5	292.5	"
	TUBE, REC.	5726/6AL5W	1	32.5	32.5	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"

SUM OF Nλ: 40[illegible].09

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/7?

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 11	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				CV-742D FREQ. CONV.	OSC.- MIXER		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M (12) CK60AW102M (13)	25	.44	11.0	NS
	CAPACITOR, FIXED CERM.	CC30UJ620J (6) CC30UJ101J (3)	14	.44	6.16	"
	———	CC20UJ030C (1) CC20UJ300J (1)	—	—	—	"
	———	CC20UJ150G (1) CC20UJ050C (1)	—	—	—	"
	———	CC30UJ820J (1)	—	—	—	"
	CAPACITOR, FIXED MICA	CB21PD101J (1) 1000PF ±20% 500VDC (6)	7	.99	6.930	"
	CAPACITOR, FIXED PAPER	CPV09A1KF103KM (1) CPV09A1KE104KM (1)	3	.0016	.005	"
	———	CPV09A1KC105KM (1)	—	—	—	"
	CAPACITOR, FIXED PAPER	CP11A3KE104K (1)	1	.016	.016	"
	CONNECTOR, COAX.	UG-1094/U	1	1.1	1.1	"
	RELAY, GEN. PUR.	4PDT, 280Ω 27.5VDC	1	1.6	1.6	"
	CHOKE, RF	.25mh 0.05Ω 1.5A	16	.066	1.056	"
	COIL, RF, MOLDED	MS75008-41 (1) MS75008-30 (1)	2	.066	.132	"
	RESISTORS, FIXED COMP.	RCR20G563JM (1) RCR20G155JM (1)	31	.0077	.239	"
	———	RCR20G471JM (2) RCR20G102JM (3)	—	—	—	"
	———	RCR20G822JM (1) RCR20G223JM (1)	—	—	—	"
	———	RCR20G562JM (1) RCR20G181JM (1)		—	—	"
		SUM OF Nλ			—	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				11 CV-742D FREQ. CONV.	A2 OSC.-MIXER		2 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RCR20G392JM (2) RCR20G123JM (2)	—	—	—	NS
	—	RCR20G153JM (1) RCR20G154JM (1)	—	—	—	"
	—	RCR20G104JM (1) RCR20G222KM (2)	—	—	—	"
	—	RCR20G472JM (3) RCR20G823JM (1)	—	—	—	"
	—	RCR20G331JM (1) RCR20G121JM (1)	—	—	—	"
	—	RCR20G564JM (1) RCR20G101KM (1)	—	—	—	"
	—	RCR20G224JM (1) RCR20G471KM (1)	—	—	—	"
	—	RCR20G151KM (1)	—	—	—	"
	RESISTOR, VAR. COMP.	RV4LAYSA105B (1) RV4LAYSA253B (2)	6	22.0	132.0	"
	—	RV4LAYSA502B (3)	—	—	—	"
	TUBE, REC.	6C4WA	1	32.5	32.5	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"
	TUBE, REC.	8113	1	32.5	32.5	"
	TUBE, REC.	5654	2	32.5	65.0	"
	TUBE, REC.	5727/2D21W	1	32.5	32.5	"
	TUBE, REC.	5814A	1	32.5	32.5	"
	TUBE, REC.	5670	2	32.5	65.0	"

SUM OF Nλ [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/25/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12 AZIMUTH IND. PULSE ANALYZER	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16							

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CPV	12	.0016	.0732	Ns, $\pi_Q = 1$
	"	CM	2	.078	.156	"
	DIODE	JANIN458	5	.75	3.75	"
	LAMP INCANDESENT		20	1.0	20	"
	CONN	34-20PS	1	.56	.56	" 34 PINS, 5A, 21VAC
	"	MRE-50P-J	1	.56	.56	" 50 " " "
	"	BNC MIL UG-194/U	9	1.1	9.9	"
	"	DBF-25S-C7	1	.56	.56	" 25 PINS
	"	DCF-37S-C7	3	.56	1.68	" 37 PINS
	"	ADAPTER, 2 CONTACTS BNC MIL-UG-1094/U	2	1.1	2.2	"
	"	DAF-15S-C7	5	.56	2.8	" 15 PIN, 5A
	"	TELEPHONE JACK (COAX)	1	1.1	1.1	"
	"	DBF-25S-C7	5	.56	2.80	" 25 PIN
	"	20 AMP, 20V, 2 PIN MS3102A-12S-3S	1	.56	.56	"
	RELAY	4PDT, GP	5	1.6	8.00	"
	"	SPDT, 150V, 10 MA	1	1.6	1.6	"
	"	SPDT, 150V, 10A	1	1.6	1.6	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/26/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY:	SUBASSEMBLY:	SHEET 2 OF
WLR-1G				AZIMUTH IND. PULSE ANALYZER			

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RF, COIL	500V, steel core 1000MH, 1.65K ohms	1	.066	.066	NS
	METER, MICRO AMP		1	10	10.0	"
	RESISTOR	RCR42G823JM " RCR32G333KM "	3	.0077	.023	"
	"	RCR42G184KM, 224KM 5 RCR42G273KM (1)	6	.0077	.046	"
	"	RCR20G102KM	5	.0077	.039	"
	"	RCR20G181KM, 150KM"	4	.0077	.031	"
	"	RCR20G683KM", 472KM"	2	.0077	.015	"
	"	RCR20G105KM	5	.0077	.039	"
	"	RCR20G 154KM, 155KM	3	.0077	.023	"
	"	RCR20G105KM	4	.0077	.031	"
	"	RCR20G224JM	1	.0077	.0077	"
	"	RCR20G104KM	5	.0077	.039	"
	" , VARIABLE	RV4NAYSD105A	6	22	132	"
	" , FILM	RN65B2151F	1	.03	.03	"
	" "	RN65B1331F, 2370F	1	.03	.03	"
	RESISTOR, VARIABLE	RV4LAYSA104B	1	.03	.03	"
	" "	RV4NAYSD103A	1	.03	.03	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY:	SUBASSEMBLY:	SHEET 3 OF
WLR-1G				AZIMUTH IND, PULSE ANALYZER			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESISTOR, VARIABLE	RV4NAYSD504A	10	.03	.30	NS
	" "	RP101FH320KK	1	7.5	7.5	"
	SWITCH, TOGGLE, DP	MS35059-22(2), 31(1)	3	.68	2.04	"
	" " DPDT	250VAC, 5A; 30VDC, 4A	1	.68	.68	"
	" P/3, DPDT	250VAC, 3A,	1	.46	.46	"
	TRANSFORMER, PWR	115VAC, 60HZ MFG 80089, P/N 26740	1	.064	.064	"
	" "	115VAC, 60HZ MFG 80089 P/N 26445	1	.064	.064	"
	" "	115V, 60HZ MFG 80079, P/N 25347	1	.064	.064	"
	TUBE, ELECTRON, CRT	7YP2	1	97.5	97.5	"
	" " , CRT	5FPT399M	1	97.5	97.5	"
	LAMP, NEON	NE-2	6	.2	1.2	"
	12A1 VIDEO AMP	545 1694 005	1	223.666	223.666	"
	12A2 PANORAMIC AMP		1	206.141	206.141	"
	12A3 0-5 MSEC SWEEP		1	320.157	320.157	"
	12A4 PULSE STRETCHER		1	349.423	349.423	"
	12A5 5-500 MSEC SWEEP		1	302.941	302.941	"
	12A6	NOT USED	—	—	—	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12 AZIMUTH IND PULSE ANALYZER	ASSEMBLY:	SUBASSEMBLY:	DATE 10/27/72 SHEET 4 OF
WLR-16							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	12A7 0.5 – 50,000 NSEC SWEEP		1	243.992	243.992	Ns
	12A8 HORIZONTAL-VERTICAL AMP		1	218.099	218.099	"
	12A9 DE PRE AMP		1	168.732	168.732	"
	12A10 SCAN VIDEO AMP		1	182.002	182.002	"
	12A11 DF/SCAN SELECTOR		1	1.6	1.6	"
	12A12 SCAN DEFLECTION		1	215.472	215.472	"
	12A13 FREQUENCY INDICATOR		1	486.291	486.291	"
	12A14 INDICATOR SERVO AMP		1	153.307	153.307	"
	12A15 ELECTRICAL EQUIPMENT CABINET		1	11.003	11.003	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
IVLR-1G				12 AZIMUTH IND. PULSE ANALYZER	12A1 VIDEO AMP		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, PAPER	CPV07A1KC224KM	1	.0016	.0016	Ns
	" , MICA	CM15E101G	1	.078	.078	"
	, PAPER	CPV09A1KE473KM	2	.0016	.0032	"
	" "	CP11A3KC224K	2	.0016	.0032	"
	" MICA	CM15E151G	1	.078	.078	"
	" CER	CK06AW102M	4	.44	1.76	"
	" "	CC20CH050C	1	.44	.44	"
	" "	CC30CH180J	29	.44	12.76	"
	" "	CC20CH050C	1	.44	.44	"
	" PAPER	CPV07A1KB104K	1	.0016	.0016	"
	" MICA	CM20D102G03	2	.078	.156	"
	" PAPER	CPV09A1KC474KM	1	.0016	.0016	"
	" "	CPV09A1KC473KM	1	.0016	.0016	"
	CONNECTOR, CONX	TEFLON DIEL, 1.25KV, 5A	2	.56	1.12	"
	CONN.	MER 8132, P/N SM55K	1	.56	.56	"
	COIL, RF	MS 75008	38	.56	21.28	"
	" "	MS 90542-16	1	.066	.066	"

SUM OF Nλ:

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/27/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12 AZIMUTH IND. PULSE ANALYZER	ASSEMBLY: 12A1 VIDEO AMP.	SUBASSEMBLY:	SHEET 2 OF
WIR-15							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CHOKE	MS91189-	2	.066	.132	NS
	RESISTOR	RCR20G621JM	1	.0077	.0077	"
	" VARIABLE, WW	RVGLNYSA251B	1	22	22.0	"
	"	RCR 20G104KM	9	.0077	.069	"
	"	" 121KM	1	.0077	.0077	"
	"	RCR42G332KM	3	.0077	.023	"
	"	RCR 32G103KM	1	.0077	.0077	"
	"	RCR 32G105KM	1	.0077	.0077	"
	"	RCR42G[illegible]	3	.0077	.023	"
	"	RCR 20G332JM	3	.0077	.023	"
	"	RCR 20G102KM	5	.0077	.039	"
	"	RCR 20G150KM	4	.0077	.031	"
	FILM	RN 65B 3570F	1	.030	.030	"
	PCB	80 connections	3	.0048	.014	"
	TUBE	5670, 5847, 5814 6CL6, 5987	5	32.5	162.5	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				AZIMUTH IND PULSE ANALYZER	PAN AMP		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, PAPER	CPV07 AXXXXXX	8	.0016	.013	N_S
	MICA	CM15F	3	.078	.234	"
	DIODE	JAN 1N458, 1N3274	4	.75	3.00	"
	CONN. COAX	CN401-F-80	4	1.1	4.40	"
	RELAY, 4PDT		1	1.6	1.60	"
	CONN.	MFR 75173 DC-37P-C7	1	.56	.56	"
	RESISTOR	RCR20GXX5KM	8	.0077	.062	"
	"	RCR20GX.5KM - XX1KM	12	.0077	.092	"
	"	RCR20GXXXKM	5	.0077	.039	"
	" VARIABLE	RV6LAYSAXXX B	3	22	66	"
	"	RCR32GXX3KM - 1KM	6	.0077	.046	"
	" FILM	RN65B1XX3F - 2F	3	.03	.09	"
	PCB	100 CONNECTIONS	1	.0048	.0048	"
	TUBE, RECEIVING		4	32.5	130.0	"
		SUM OF Nλ:			201.111	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12 PULSE ANALYZER	ASSEMBLY: A3 0-5MSEC SWEEP	SUBASSEMBLY:	SHEET 1 OF
WLR-1G							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, PAPER	CPV07A1CCXXXKM – XX2KM	6	.0016	.010	N_S
	" MICA	CM15E471G –	3	.078	.234	"
	" CER	CC20CH100C – XX0J	5	.44	2.2	"
	" VAR. CER	CV	1	2.7	2.7	"
	" ELECT. ST.	CS	1	.56	.56	"
	DIODE	JAN 1N458	9	.75	6.75	"
	CONN, COAX	CN401-F-80	1	1.1	1.1	"
	"	MFR 81312 M45-L2N	1	.56	.56	" 2 [illegible]
	COIL, RF		5	.066	.33	"
	" "	MS-9[illegible]-23	1	.066	.066	"
	RESISTOR	RCR20GXX34.n – 1KM	12	.0077	.092	"
	"	RCR20GXX4KM	8	.0077	.062	"
	"	RCR20GXX5KM	5	.0077	.039	"
	"	RCR32GXX2KM	2	.0077	.015	"
		RCR42	9	.0077	.069	"
		RN65BXXX1F – XXX3F	8	.03	.24	"
		RN70BXXX3F	1	.03	.03	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A3	SUBASSEMBLY:	SHEET 2 OF
WLR-16				PULSE ANALYZER	0-5 MSEC SWEEP		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESISTOR	RN75BXXX:F	3	.03	.09	'' NS
	RESISTOR, VARIABLE	RV6LA[illegible]XX3B	5	22	110	'' ''
	PCB	80 connections	2	.0048	.010	''
	TUBES, RECEIVING		6	32.5	195	''

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A4 PULSE STRETCHER	SUBASSEMBLY:	DATE 10/29/78 SHEET 1 OF
WLR-1G							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR PAPER	CPV09A1KF xx3KM	11	.0016	.018	N_S
	" "	CPV09A1KF xx4KM	3	.0016	.005	"
	" "	CPI [illegible] KF xx4K	3	.0016	.005	"
	" MICA	CM15C100J	4	.078	.312	"
	DIODE	JAN IN458	7	.75	5.25	"
	"	JAN IN627	2	.75	1.50	"
	CONN COAX	CN401-F-80	2	1.1	2.2	"
	"	[illegible]	1	.56	.56	"
	RELAY 4PDT	[illegible]	1	1.6	1.6	"
	RESISTOR	[illegible] - xx 6K	17	.0077	.131	"
	"	RCR20Gxx5K	10	.0077	.077	"
	"	RCR32Gxx3K, xx4K	13	.0077	.100	"
	"	RCR 42Gxx4K	2	.0077	.015	"
	"	RN70 [illegible] F	1	.03	.03	"
	"	R [illegible] 2F, xxx3F	4	.03	.12	"
	"	RV6LAY	5	22	110.0	"
	TUBE RECEIVER		7	32.5	227.5	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A5 5-500 MSEC SWEEP	SUBASSEMBLY:	SHEET 1 OF
WLR-15							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR PAPER	CP107A1XXX3KM, XXX4KM	5	.0016	.008	NS
	MICA	CM15EXX1G	5	.078	.390	"
	" MICA	CM20DXX1G	1	.078	.078	"
	VARIABLE CER	CV	1	2.7	2.7	"
	DIODE	JAN 1N458	4	.75	3.0	"
	CONN. COAX	CN401-F-80	1	1.1	1.1	"
	CONN.	M45-LRN	1	.56	.56	"
	RESISTOR	[illegible]	14	.0077	.108	"
	"	[illegible]	3	.0077	.023	"
	"	RCR32GXX3K	1	.0077	.0077	"
	"	RCR42KXX	6	.0077	.046	"
	"	RN65BXXX1F - XXX3F	6	.03	.180	"
	"	RN70BXXX1F - XXX3F	2	.03	.060	"
	"	RN75BXXX1F - 3F	6	.03	.180	"
	" , VARIABLE	RVG5C[illegible]YSXXX3B	6	22	132.0	"
	TUBE, RECEIVER		5	32.5	162.5	"
					300.911	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A5 5-500 MSEC SWEEP	SUBASSEMBLY:	SHEET 1 OF
WLC-1G							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR PAPER	CP107A1xxx3KM, xxx4KM	5	.0016	.008	NS
	" MICA	CM15ExxIG	5	.078	.390	"
	" MICA	CM20DxxIG	1	.078	.078	"
	VARIABLE CER	CV	1	2.7	2.7	"
	DIODE	TX 1N458	4	.75	3.0	"
	CONN. CONX	CN401-F-80	1	1.1	1.1	"
	CONN.	M45-LRN	1	.56	.56	"
	RESISTOR	[illegible]	14	.0077	.108	"
	"	[illegible]	3	.0077	.023	"
	"	RCR32GxxxJ	1	.0077	.0077	"
	"	RCR42Gxx	6	.0077	.046	"
	"	RN65BxxxxF - xxx3F	6	.03	.180	"
	"	RN70BxxxxF - xxx3F	2	.03	.060	"
	"	RN75BxxxxF - 3F	6	.03	.180	"
	" , VARIABLE	CVG5C[illegible]Sxxx3B	6	22	132.0	"
	TUBE, RECEIVER		5	32.5	162.5	"
					300.9[illegible]	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM: WLR-1G	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A7 0.5–50,000 MSEC SWEEP	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CPV09A1XXX3M - XXX4	3	.0016	.005	Ns
	"	CM35CXXXG	1	.078	.078	"
	"	CM15EXXXG	3	.078	.234	"
	"	CM30EXXXG	1	.078	.078	"
	"	CP1A34CXXXK	1	.0016	.0016	"
	DIODE	JAN1N458	4	.75	3.0	"
	RESISTOR	RCR20GXXG-XX4K	10	.0077	.077	"
	"	RCR20GXX5K	1	.0077	.0077	"
	"	RCR32GXX	2	.0077	.015	"
	"	RCR42GXX3	2	.0077	.015	"
	"	RN65BXXX-XXX3E	10	.03	.30	"
	"	RN70BXXX1F - XXX3F	2	.03	.06	"
	"	RN75BXXX1F - 3F	4	.03	.12	"
	" VARIABLE	RVGLAYSXXX3B	5	22	110.0	"
	TUBE, RECEIVER		4	32.5	130.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM: WLR-1G	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A8 HORIZONTAL-VERTICAL AMP	SUBASSEMBLY:	DATE 10/29/72 SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESISTOR	RVGLAYSXXX3B	4	22	88.0	NS
	"	RCR20GXX14-XX4R	12	.0077	.092	"
	CAPACITOR	CPV09NIKE473KM	4	.0016	.006	"
	TUBE, RECEIVER		4	32.5	130.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				12	A9 DF PRE AMP		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CM05FDXXXJ03	4	.078	.312	NS
	"	CPV09[illegible]473KM	9	.0016	.014	"
	"	CM06FDXXXJ03	3	.078	.234	"
	RESISTOR	RCR20G[illegible]-XX4K	30	.0077	.231	"
	"	RCR32GXX1K-XX3K	3	.0077	.023	"
	"	RCR[illegible]K	1	.0077	.0077	"
	TUBE, RECEIVER		5	32.5	162.5	"
	DIODE	1N914	6	.75	4.5	"
	"	1N3[illegible]35B	1	.91	.91	"

SUM OF Nλ 168.73

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A10 SCAN VIDEO AMP	SUBASSEMBLY:	SHEET 1 OF
WLR-16							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CPL09AIKE[illegible]KM	4	.0016	.006	/// Ns
	"	CM15E[illegible]1K	3	.078	.234	/// "
	RESISTOR	RCR20G[illegible]K – [illegible]4K	25	.0077	.193	[illegible] "
	"	RCR20G[illegible]5K	5	.0077	.039	[illegible] "
	"	RCR39G	4	.0077	.031	/// "
	"	RV6LAYSN[illegible]	2	22	44	/ "
	DIODE	JAN1N458	10	.75	7.5	"
	TUBE, RECEIVER		4	32.5	130.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				12	A11 DF/SCAN SELECTOR		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RELAY 6PDT	MIL RY4LC3A3L01	1	1.6	1.6	NS

AD-A072 056 EVALUATION RESEARCH CORP SAN DIEGO CA F/G 17/4

AVAILABILITY STUDY OF THE AN/WLR-1G AND AN/SLQ-32(V)2 ELECTRONI--ETC(U)

FEB 79 J VALENZUELA, W EICHELBERGER N66001-78-R-0318

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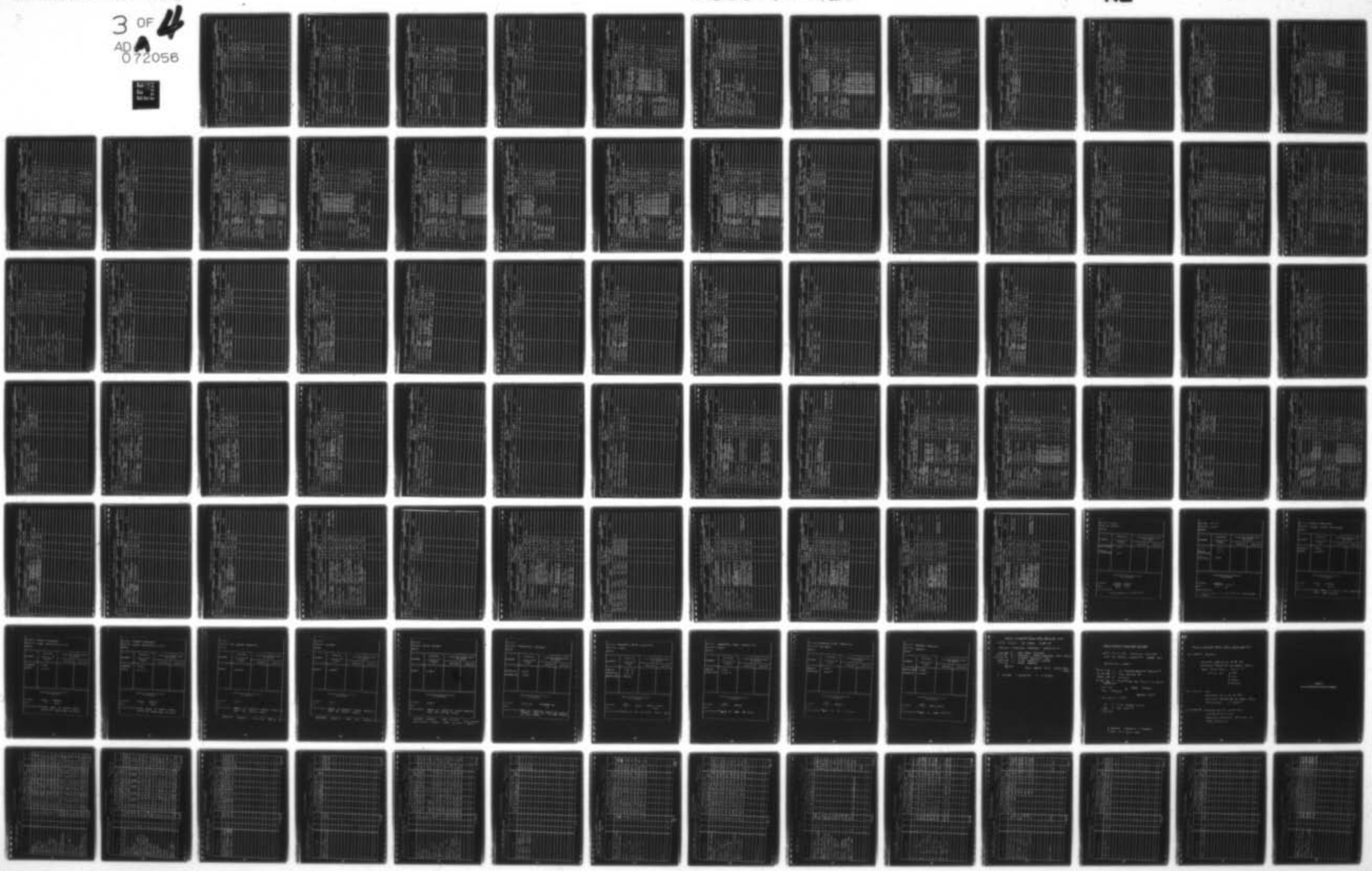


7205

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM: WLR-16	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12 PULSE ANALYZER	ASSEMBLY: #12 SCAN DEFLECTION ASSEMBLY	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, DC	MER 27780 P/N EH10333	1	55	55	NS
	CAPACITOR	CPIIA3C[illegible]	1	.0016	.0016	"
	GENL		2	.236	.472	"
	RESISTOR	RCR20GXX3[illegible]	4	.0077	.031	"
	"	RVGLAYSN[illegible]3B	4	22	88.0	"
	"	RCR20G[illegible]	1	.0077	.0077	"
	" WW ACC	MER 3138 5615-77-0 CC	1	6.1	6.1	"
	"	RW[illegible]	1	.43	.43	"
	"	RW 20[illegible]	1	.43	.43	"
	TUBE, RECEIVER		2	32.5	65.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A13 FREQUENCY INDICATOR	SUBASSEMBLY:	SHEET 1 OF
WLR-16							

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS	
	MOTOR, 1.5W	MER 19090 52HAX7-4	1	55	55	NS	
	LAMP		6	1.0	6.0	"	
	COUNTER, MECH.	(4 BEARINGS	1	8.236	8.236	"	G
	GEAR		9	0.289	2.60	"	G
	SPRING		2	0.00	.00	"	
	RESISTOR	RV6LAYSA XX18 - 3B	18	22	396	"	
	" VARIABLE, PREC.	10 TAPS, 400K, 10 TURN	1	6.1	6.1	"	
	BEARING,		6	2.059	12.354	"	G

SUM OF N λ's 486.291

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
ULR-1G				12	A14 Indicator Servo Amp		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR	CPV09A1KC XX 4M	13	.0016	.021	Ns
		CQ09A1MC154J3	1	.016	.016	"
	CHOPPER:					"
	TRANSISTOR	NPN, SI	4	.26	1.1	"
	TRANSFORMER	MIL-T-27, PULSE	1	.0083	.0083	"
	RESISTOR	RCR20GXX1K – 4K	15	.0077	.116	"
		RCR20GXX5K	1	.0077	.0077	"
		RVLAYSXX1B	1	22	22.0	"
		RCR32GXYXKM	5	.0077	.039	"
	TUBE, RECEIVER		4	32.5	130.0	"

SUM OF Nλ: 153.307

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/78

SYSTEM: WLR-1G	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 12	ASSEMBLY: A15 ELECT. EQUIP CABINET	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, FAN	MAR 02519 6-10493	1	11	11	
	CAPACITOR	CP53B1FFxxM	2	.0016	.0032	
	FILTER (A/C)		1	0.00	.00	PREVENT. MAINT. ITEM
	SPRING		1	0.00	.00	
				SUM OF N λ's	11.003	

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 13	ASSEMBLY:	SUBASSEMBLY:	DATE 10/30/78
WLR-1G				C-2697G			SHEET 1 OF

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED PAPER	CP53B1FB405K	2	.016	.032	Ns
	DIODE SILICON RECTIFIER	1N645	1	.75	.75	"
	LAMP, INCAND.	MS25237-328	10	1.0	10.0	"
	CONNECTOR, RACK & PANEL	50 CONT. 5A 2100VAC (1) 34 CONT. 5A 2100VAC (1)	3	.56	1.68	"
	———	25 CONT. DBF-25S-C7 (1)	—	—	—	"
	RELAY, GEN. PUR.,	4PDT, 280Ω 27.5VDC	1	1.6	1.6	"
	RESISTOR, FIXED COMP.	RCR32G223KM (5) RCR20G683KM (2)	12	.0077	.0924	" 1 WATT
	———	RCR20G221KM (1) RCR20G121KM (1)	—	—	—	"
	———	RCR20G102KM (1) RCR20G331KM (1)	-	—	—	"
	———	RCR20G181KM (1)	—	—	—	"
	RESISTOR, VAR. WW	RP101FH3R0KK (1)	1	7.5	7.5	"
	RESISTOR, VAR. COMP.	RV4NAYSK503B (2) RV4LAYSA104B (9)	11	22.0	242	"
	RESISTOR, FIXED FILM	RN65B1473F (2)	2	.03	.06	"
	RESISTOR, VAR. W.W.	5000Ω ±10% 2W	2	8.6	17.2	" RA
	SWITCH, ROTARY		4	1.7	6.8	"
	SWITCH, TOGGLE		2	.68	1.36	"
	SWITCH, SENS.		1	1.1	1.1	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				13 C-2697G			SHEET 2 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	TRANSFORMER, PWR.	PRI. 115VAC 57/63 Hz SEC. 6VAC @ 4A SEC. 6.3VAC @ 2.3A	1	.064	.064	NS
	SERVO AMP. TUNER ASSY.	A1	1	502.802	502.802	"
	CABINET	A2	1	1.12	1.12	"
	MAN. TUNE DRIVE ASSY.	A3	1	87.428	87.428	"
	STORAGE CHAN. ASSY.	A4	1	33.236	33.236	"
	CLUTCH, MAGNETIC	24-32VDC 3W	2	1.776	3.552	"
	GEAR, PINION	16T (1) 24T (2)	3	.236	.708	"
	GEAR, BEVEL	STAINLESS STEEL 16T	2	.236	.472	"
	COUPLING, SHAFT, FLEX.		1	.54	.54	"
	BEARING, BALL		2	.70	1.40	"
	GEAR, STOP	48T	2	.236	.472	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 13	ASSEMBLY: A1	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				C-2697G	SERVO AMP. TUNER		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED PAPER	CPV09A1KB104K (1) CPV09A1KC103KM (1)	12	.0016	.019	Ns
	—	CPV09A1KE332KM (2) CPV09A1KF224KM (1)	—	—	—	"
	—	CPV09A1KF103KM (3) CPV09A1KF223KM (4)	—	—	—	"
	CAPACITOR, FIXED PAPER	CP09A1KC472KM (2) CP5481EB205K (1)	4	.016	.064	"
	—	10mf ±20% 200VDC (1)	—	—	—	"
	DIODE, SILICON	JAN 1N458	4	.75	3.00	"
	CHOPPER, TRANSISTOR	4 PNP TRANSISTORS + 1 TRANSFORMER	1	6.82	6.82	"
	RELAY, GEN. PUR.	4PDT, 280Ω 27.5VDC	1	1.6	1.6	"
	CONNECTOR, RACK & PANEL	25 CONTACTS DB-25P-C7	1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G104KM (8) RCR42G683KM (1)	46	.0077	.354	"
	—	RCR20G103KM (4) RCR20G105KM (7)	—	—	—	"
	—	RCR20G683KM (2) RCR20G225KM (2)	—	—	—	"
	—	RCR20G564KM (2) RCR32G333KM (1)	—	—	—	"
	—	RCR32G393KM (1) RCR20G123KM (1)	—	—	—	"
	—	RCR20G224KM (1) RCR20G332KM (3)	—	—	—	"
	—	RCR20G473KM (2) RCR20G474KM (2)	—	—	—	"
	—	RCR42G222KM (1) RCR42G103JM (1)	—	—	—	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				13 C-2697G	A1 SERVO AMP. TUNER		2 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RCR42G101JM (1) RCR20G472KM (1)	—	—	—	NS
	—	RCR20G393JM (2) RCR20G474JM (1)	—	—	—	"
	—	RCR20G103JM (2)	—	—	—	"
	RESISTOR, VAR. COMP.	RV4LAYSA253B (2) RV6LAYSA503B (1)	6	22.0	132	"
	—	RV6LAYSA105B (1) RV6LAYSA253B (1)	—	—	—	"
	—	RV4LAYSA252A (1)	—	—	—	"
	RESISTOR, FIXED WW PWR.	RW29V162 (1) RW29V201 (1)	2	.43	.86	"
	TRANSFORMER, AUDIO	10W PRI. 8000Ω CT 2000V SEC. 680Ω 500V	1	.02	.02	"
	TUBE, REC.	5814A	2	32.5	65.0	"
	TUBE, REC.	12AT7WA	3	32.5	97.5	"
	TUBE, RECT.	OB2WA	1	65.0	65.0	"
	TUBE, RECT.	6005/6AQ5W	2	65.0	130.0	"
	P.C. BOARD		1	.0048	.0048	"

SUM OF Nλ: 502.802

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 13	ASSEMBLY: A2	SUBASSEMBLY:	
WLR-16				C-26976	CABINET		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONNECTOR RACK + PANEL	50 CONT. 2100VAC 5A (1) PLASTIC DIELECTRIC 50-20H	2	.56	1.12	NS
	———	34 CONT. 2100VAC 5A (1) MRE-34S-JTC-H	—	—	—	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				13 C-26976	A3 MAN. TUNE DR.		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CLUTCH, MAG.		10	1.776	17.76	Ns
	RESISTOR, VAR. LIN. PREC.	100K Ω ±3% 6.9W SA2350C	10	6.1	61.0	"
	GEAR, PINION	16T (10) 60T (3)	13	.236	3.068	"
	BEARING, BALL		8	.70	5.60	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				13 C-2697G	A4 STOR. CHAN.		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	LAMP, PANEL	MS25237-328R	11	1,0	11,0	Ns
	SWITCH, SENS.	SPDT 5A @ 125VDC 3A @ 30VDC IND. 11SM3-T 4A @ 30VDC RES.	20	1,1	22,0	"
	GEAR, MITER, NO. 1	STAINLESS STEEL 16T	1	.236	.236	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				14 RF-89D FREQ. DISC.			SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M (11)	11	.44	4.84	N_s
	CAPACITOR, FIXED PAPER	CP5382EF205M	1	.016	.016	"
	CONNECTOR, COAX.		9	1.1	9.9	"
	CONNECTOR, RACK & PANEL	4 CONT. 750VDC 15A 16 CONT. 900VAC 5A	1	.56	.56	"
	RELAY, COAX.	SPDT 50Ω 100W 50MHz 28VDC 300Ω COIL	1	1.6	1.6	"
	TRANSFORMER, PWR.	PRI. 115V 60Hz SEC. 6.3V @ 5A CT.	1	.064	.064	"
	160MHz CONV. ASSY.	A1	1	181.205	181.205	"
	60MHz LIM. + DISC. ASSY.	A2	1	289.910	289.910	"
	AUTO. FREQ. CONTROL ASSY.	A3	1	217.260	217.260	"
	11 MHz. DISC. ASSY.	A4	1	159.846	159.846	"
	VIDEO AMP. ASSY.	A5	1	128.622	128.622	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				14 RF-89D FREQ. DISC.	A1 160MHz CONVERTER		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK60AW102M (24)	24	.44	10.56	NS
	CAPACITOR, FIXED CERM.	CC30UJ101J (3) CC20UK020C (1)	5	.44	2.20	"
	———	CC20CH200G (1)	—	—	—	"
	CAPACITOR, FIXED GLASS	470pf ±5% 500VDCW 250ppm/°C TC	5	.25	1.25	"
	CONNECTOR, COAX.	UG-1094/U (1) 1 CONT. 500VDC PLAS. DI. (1)	2	1.1	2.2	"
	COIL, RF, MOLDED	MS75008-35 (3) MS75008-26 (1)	14	.066	.924	"
	———	MS75008-23 (2) MS75008-34 (8)	—	—	—	"
	CHOKE, RF	0.25μh 0.05Ω 1.5A	1	.066	.066	"
	CONNECTOR, RACK + PANEL	15 CONT. 490VDC @ 5A DA-15P-C7	2	.56	1.12	"
	RESISTOR, FIXED COMP.	RCR20G470KM (2) RCR20G474KM (1)	11	.0077	.085	"
	———	RCR20G181KM (1) RCR20G101KM (3)	—	—	—	"
	———	RCR20G472KM (1) RCR20G471KM (2)	—	—	—	"
	———	RCR20G100JM (1)	—	—	—	"
	RESISTOR, FIXED FILM	RN65B5110F (1) RN65B2151F (2)	3	.03	.09	"
	TUBE, REC.	5725/6AS6W	1	32.5	32.5	"
	TUBE, REC.	5654	3	32.5	97.5	"
	TUBE, REC.	5670	1	32.5	32.5	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 2 OF
WLR-1G				14 RF-89D FREQ. DISC.	A1 160 MHz. CONVERTER		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CRYSTAL, QUARTZ	110 MHz 0.005% TOL. 5th OVERTONE, SER. RES.	1	0.2	0.2	Ns
	P.C. BOARD	EPOXY	2	.0048	.010	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				14 RF-89D FREQ. DISC.	A2 60MHz LIM. + DISC.		1 OF.

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK60AW102M (30) CC30UJ101J (5) CC20CK0R5C (1)	36	.44	15.84	NS
	———		—	—	—	"
	CAPACITOR, FIXED GLASS	470pf ±5% +250 ppm/°C 500VDCW (4)	4	.25	1.0	" CY
	CAPACITOR, FIXED ELECTRO.	CL31CN020MP3 (3)	3	1.1	3.3	"
	CAPACITOR, VAR. GLASS	PC36H080 (7)	7	.47	3.29	"
	DIODE, SILICON	1N251	4	.75	3.0	"
	CONNECTOR, COAX.		3	1.1	3.3	"
	RELAY	DPDT, 28VDC OR 115VAC @ 2A, 10K Ω COIL 6mA TRIP	1	1.6	1.6	"
	COIL, RF MOLDED	MS75008-34	12	.066	.792	"
	CONNECTOR, RACK & PANEL	15 CONT. 490VDC 5A DA-15P-C7	1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G221KM (1) RCR20G562KM (1)	13	.0077	.100	"
	———	RCR20G561KM (1) RCR20G821KM (1)	—	—	—	"
	———	RCR20G121KM (3) RCR20G222KM (1)	—	—	—	"
	———	RCR20G104KM (3) RCR20G121K (1)	—	—	—	"
	———	RCR20G102KM (1)	—	—	—	"
	RESISTOR, FIXED FILM	RN65B75R0F (1) RN65B1470F (1)	24	.03	.720	"
	———	RN65B2871F (1) RN65B1961F (1)	—	—	—	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				14 RF-89D FREQ. DISC.	A2 60 MHz. LIM. & DISC.		SHEET 2 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RN65B5620F (1) RN65B4640F (1)	—	—	—	NS
	—	RN65B6810F (1) RN65B1004F (4)	—	—	—	"
	—	RN65B5621F (4) RN65B4642F (1)	—	—	—	"
	—	RN65B1473F (1) RN65B1213F (1)	—	—	—	"
	—	RN65B1103F (1) RN65B3480F (1)	—	—	—	"
	—	RN65B3161F (1) RN65B2151F (1)	—	—	—	"
	—	RN65B1333F (1) RN65B4624F (1)	—	—	—	"
	RESISTOR, VAR. COMP.	RV6LAYSA103B (1) RV6LAYSA252B (1)	2	22.0	44.0	"
	RESISTOR, VAR. WW.	20KΩ ±10% 0.8W	2	8.6	17.2	"
	RF TRANSFORMER		3	.066	.198	"
	TUBE, REC.	5654	5	32.5	162.5	"
	TUBE, REC.	6BN6	1	32.5	32.5	"
	P.C. BOARD	GLASS EPOXY	2	.0048	.010	"
					[illegible]	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				14 RF-89D FREQ. DISC.	A3 AUTO. FREQ. CONTROL		1 OF

INDEX NUMBER	NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK60AW102M	14	.44	6.16	N_S
	CAPACITOR, FIXED PAPER	CP11A3KB105K (1) 10mf ±20% 200VDC (1)	2	.016	.032	"
	CAPACITOR, FIXED CERM.	CC30UJ620J (3) CC20CH100C (1)	6	.44	2.64	"
	———	CC30UJ101J (2)	—	—	—	"
	CAPACITOR, FIXED GLASS	470pf ±5% +250ppm/°C 500VDCW	3	.25	.75	" CY
	CONNECTOR, COAX.	500VDC	1	.56	.56	"
	RELAY, GEN. PUR.	28VDC OR 115VAC @2A 10K-Ω COIL 6mA, TRIP	1	1.6	1.6	"
	COIL, RF, MOLDED	MS75008-35 (3) MS75008-41 (2)	15	.066	.990	"
	———	MS75008-34 (10)	—	—	—	"
	CONNECTOR, COAX.		1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G154KM (1) RCR20G561KM (1)	16	.0077	.123	"
	———	RCR20G563KM (1) RCR20G152KM (1)	—	—	—	"
	———	RCR42G102KM (1) RCR20G822KM (1)	—	—	—	"
	———	RCR20G471KM (1) RCR20G224KM (1)	—	—	—	"
	———	RCR20G105KM (1) RCR20G222KM (1)	—	—	—	"
	———	RCR20G103KM (2) RCR20G473KM (1)	—	—	—	"
	———	RCR20G104KM (1) RCR20G121KM (1)	—	—	—	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				14 RF-89D FREQ. DISC.	A3 AUTO. FREQ. CONTROL		2 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	—	RCR20G102KM (1)	—	—	—	Ns
	RESISTOR, FIXED FILM	RN65B3160F (1) RN65B1473F (3)	8	.03	.240	"
	—	RN65B1783F (1) RN75B5232F (1)	—	—	—	"
	—	RN75B4532F (1) RN65B2871F (1)	—	—	—	"
	RESISTOR, VAR. WW.	1KΩ ±10% 0.8W	1	8.6	8.6	"
	TUBE, REC.	5751	1	32.5	32.5	"
	TUBE, REC.	6C4WA	2	32.5	65.0	"
	TUBE, REC.	6AH6WA	1	32.5	32.5	"
	TUBE, REC.	5654	2	32.5	65.0	"
	P.C. BOARD		1	.0048	.0048	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				14 RF-89D FREQ. DISC.	A4 11MHz. DISC.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK60AW102M	14	.44	6.16	Ns
	CAPACITOR, FIXED CERM.	CC32UJ301F (1) CC20SH060D (2)	3	.44	1.32	"
	DIODE, SILICON	1N251	4	.75	3.0	"
	CONNECTOR, COAX.		3	1.1	3.3	"
	RELAY	DPDT 28VDC OR 115 VAC @ 2A 10KΩ COIL	2	1.6	3.2	"
	COIL, RF, MOLDED	MS75008-41 (2) MS75008-34 (5)	7	.066	.462	"
	CONNECTOR, RACK & PANEL	15 CONT. 490VDC @ 5A DA-15P-C7	1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G223KM (1) RCR20G820KM (1)	19	.0077	.146	"
	—	RCR20G272KM (1) RCR20G225KM (1)	—	—	—	"
	—	RCR20G101KM (1) RCR20G470KM (2)	—	—	—	"
	—	RCR20G121KM (2) RCR20G154KM (2)	—	—	—	"
	—	RCR20G104KM (2) RCR20G105KM (2)	—	—	—	"
	—	RCR20G474KM (2) RCR20G564KM (2)	—	—	—	"
	RESISTOR, VAR. COMP.	RV6LAYSA504B (2)	2	22.0	44.0	"
	TRANSFORMER, RF		3	.066	.198	"
	TUBE, REC.	6BA7	1	32.5	32.5	"
	TUBE, REC.	5654	2	32.5	65.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	DATE
WLR-16				14 RF-89D FREQ. DISC.	A5 VIDEO AMP.		10/31/78 SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED ELECTRO.	CL33CD100MNI (1) CL21CN040SP3 (2)	3	1.1	3.3	Ns
	CAPACITOR, FIXED ELECTRO.	CP05A1KB224K (1) CP05A1KC104K (1)	2	.016	.032	"
	CAPACITOR, FIXED PAPER	CPV09A1KC104KM (1) CPV09A1KE473KM (3)	4	.0016	.006	"
	CAPACITOR, FIXED MICA	CM20E242G (1)	1	.078	.078	"
	CAPACITOR, FIXED PAPER	10mf ±20% 200VDCW 1.0mf ±5% 200VDCW	2	.016	.032	"
	CONNECTOR, COAX.	1 CONT. 500VDC (2) UG-1094/U (1)	3	1.1	3.3	"
	RELAY, GEN. PUR.	DPDT 28VDC OR 115 VAC @ 2A 10K Ω COIL	1	1.6	1.6	"
	COIL, RF	220 mh 5.9 Ω 290ma. 1 π SEC.	1	.066	.066	"
	CONNECTOR, RACK & PANEL	15 CONT. 490VDC 5A	1	.56	.56	"
	RESISTOR, FIXED COMP.	RCR20G332KM (1) RCR20G104KM (1)	18	.0077	.139	"
	——	RCR20G224KM (1) RCR20G684KM (1)	—	—	—	"
	——	RCR42G333KM (1) RCR42G822KM (2)	—	—	—	"
	——	RCR42G103KM (2) RCR20G151KM (2)	—	—	—	"
	——	RCR20G103KM (2) RCR20G184KM (2)	—	—	—	"
	——	RCR20G102KM (1) RCR20G472KM (1)	—	—	—	"
	——	RCR20G473KM (1)	—	—	—	"
	VAR.	RV(...)A4SA504B (1)				

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/31/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 14 RF-89D FREQ. DISC.	ASSEMBLY: A5 VIDEO AMP.	SUBASSEMBLY:	SHEET 2 OF.
WLR-1G							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	TUBE, REC.	6AU6WA	1	32.5	32.5	Ns
	TUBE, REC.	6AH6WA	1	32.5	32.5	"
	TUBE, REC.	5670	1	32.5	32.5	"
	P.C. BOARD	EPOXY, GLASS	2	.0048	.010	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 12/29/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 15	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				POWER SUPPLY PP2156.D			SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ		REMARKS
	CAPACITOR	CP60B1FHxx5M	1	.016	.032	/	Ns
	"	CP70B1FGxx5M	2	.016	.032	//	"
	"	CP72E1EFxx6K	2	.016	.032	//	"
	"	CP09A1	2	.016	.032	//	"
	"	CP70FF, CP41FF	4	.016	.064	////	"
	FUSE	MIL F02A250x1	6	0.1	0.6		"
	RELAY DPDT	AIER 04221 P/N 115 5AMPS	1	1.6	1.6		"
	" SPDT	1AMP	1	1.6	1.6		"
	" SPST, thermal	(C/B) 32V @ 1A	1	.40	.40		"
	DPDT	2A	2	1.6	3.2		"
	CHOKE	10H, 60MA, SEALED	1	.066	.066		"
	"	5H, 170MA/2H 170MA	1	.066	.066		"
	"	3H, 250MA/... 100MA	2	.066	.132		"
	METER		1	10	10		"
	RESISTOR	RCR32xx5M	4	.0077	.308	////	"
	"	RCR20Gxx1K-4K	22	.0077	1.694	~~////~~ ~~////~~ ~~////~~ ~~////~~ //	"
	"	RCR20Gxx5K	5	.0077	.385	~~////~~	"
		SUM OF N λ's					

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	DATE 10/27/72
WLR-1G				15 POWER SUPPLY PP2156D			SHEET 2 OF —

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESISTOR, Fixed	RCR42xx1K – 4K	18	.0077	1.386	~~~~ NS
	LAMP, INCANDESCENT		3	1.0	3.0	"
	RESISTOR, Variable	RV6LAYSxxxB	4	22	88	//// "
	" Fixed	RCR32xx1K – xx4K	2	.0077	.154	// "
	" "	RW59Vxx1 – xx8	2	.43	0.86	// "
	" "	RE19AR1000 3F 1W	1	0.9	0.9	/ "
	" "	RE17PR...F 1/2W	2	0.9	1.8	// "
	" "	RN65Bxxx=	8	.03	.24	~~~ /// "
	SWITCH, ROTARY	NON-SHORT 8POS, 2SEC .25A	1	1.7	1.7	"
	" TOGGLE	125V, 20A MS35059-22	1	.68	0.68	"
	SWITCH PUSHBUTTON	MS25040-9 810F4	1	.46	.46	"
	TRANSFORMER, POWER	60HZ 1800V@30MA STEPUP, HER. SEALED	5	.064	.32	"
	TUBE, RECTIFIER		2	65	130	"
	TUBE, REGULATOR (GAS DIODE)		3	65	195	"
	TUBE, RECEIVER		10	32.5	325	"
	A15 ELECTRICAL EQUIPMENT CABINET		1	11.096	11.096	"
	DIODE	1N3614(20) 1N1202	22	.75	16.5	"
			SUM OF N λ's		794.339	

MTBF = 1259 HRS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				15 POWER SUPPLY PP2156D	A15 CABINET		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, FAN	02579 5-10493 115V 60HZ	1	11	11	Ns
	CAPACITOR	CP53B1FF 600V	1	.016	.016	"
	"	CP53B1EE 400V	1	.016	.016	"
	FILTER, RFI	125V, 10A	2	.064	.064	"

SUM OF Nλ: 11.096

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/7?

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 16	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16				POWER SUPPLY PP-2157D			

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS	
	CAPACITOR	CP60B1FHxx5M	6	.016	.096	卌 I	NS
		CPV09A1KE104KM 600V	7	.016	.112	卌 II	"
		CP??A3KC104K 300V	6	.016	.096	卌 I	"
		CP70B1Fxxx5K 600V	7	.016	.112	卌 II	"
		CP72E1EF106K 600V	1	.016	.016	I	"
		CP54B1EG105M 1000V	1	.016	.016	I	"
		CP11A3KF103K 600V	3	.016	.048	III	"
		CM15E101G 500V	3	.078	.234	III	"
		CP10A3KCxxxM 700V	1	.016	.016	I	"
	DIODE, RECT	1N3614	36	.75	27.0		"
	LAMP, INCANDESCENT		3	1.0	3.0		"
	SWITCH, INTERLOCK (P/B)		2	.46	0.92		"
	FUSE	F02B250V/ 80089	6	0.1	0.6		"
	RELAY, GP	4PDT P/N-2309-9C 04221	2	1.6	3.2		"
	" , GP	DPDT, 5A P/N115	1	1.6	1.6		"
	REACTOR	100MA, 2-10H	2	0.066	0.132		"
	" (2 COILS)	2-5H, 300-500MH	2	0.066	0.132		"
			SUM OF Nλ's		37.33		

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/29/72

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 16	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				POWER SUPPLY PP-2157D			SHEET 2 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS	
	REACTOR	3H : 250 mA/6H, 100 ma	1	0.066	.066		Ns
	VOLTMETER		1	10	10		"
	RESISTOR Fixed	RCR 20G xx1K – xx4K	52	.0077	.4004		"
	" "	RCR 20G xx 5K	11	.0077	.0847		"
	" "	RCR 32 G xx1 – 4K	—				"
	" "	RCR 42G xx1KM – xx4KM	14	.0077	.1078		"
	" "	RN65 B xxx1 – 4M 1/4 W	51	.03	1.53		"
	" Variable	RV4LAYSAxx1 – 4A	5	22	110		"
	" "	RV4NAYSxx1 – 4A	1	22.	22	"	"
	" fixed	RW59Vxxx 3W	14	.43	6.02		"
	" "	RW29V502 11W, 5K	1	.43	.43	"	"
	" "	RN70Bxxx1 – 4F 1/2 W	1	.03	.03	"	"
	" "	RBMAKxxx1 – 2F 1/2 W	2	0.9	1.8	"	"
	" "	RB19AExxx1-2	2	0.9	1.8	"	"
	SWITCH, ROTARY, NON-SHORT	9 POS, 3 SEC 250 MA	1	1.7	1.7		"
	" PUSHBUTTON	DPDT, 3A	1	0.46	.46		"
	" TOGGLE	SPST, 4A	1	0.68	.68		"

SUM OF N λ: 157.1089

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 17	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				INTERCONNECT BOX			

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	DIODE	1N3614	1	.75	.75	NS
	LAMP, INCANDESCENT		1	1.0	1.0	"
	LAMP, NEON		3	0.2	0.6	"
	FUSE		6	0.1	0.6	"
	FILTER, RFI		6	.064	0.384	"
	CONNECTOR	MS 3110E22-21S(Y)	2	0.56	1.12	"
	RELAY, GPST	2A	19	1.6	30.4	"
	" , GP, 4PDT		4	1.6	6.4	"
	" , GP	2A	4	1.6	6.4	"
	, GP SPST	25mA	3	1.6	4.8	"
	SWITCH, PUSH SPST	0.5-3A	2	.46	0.92	"
	SWITCH, TOGGLE, DP	20A	1	.68	.68	"
				SUM OF Nλ's	54.054	MTBF = 18,500 HR

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 18	ASSEMBLY:	SUBASSEMBLY:	
WLR-1G				RADIO FREQ. TRANSMISSION LINE			SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	SWITCH, RF (2, SPDT RELAY)		1	4.446	4.446	NS
	SWITCH, RF (4 RELAY OPERATED POSITIONS)		2	8.892	17.784	"
	CONNECTOR, COAX (PART OF RF SWITCH)		9	—		"

SUM OF N λ's 22.230

MTBF = 44,984 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-18				20 CY-2518D			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CABINET ASSY.	20A1	1	11.12	11.12	Ns
	CABINET ASSY.	20A2	1	15.52	15.52	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				20 CY-2518D	A1 CABINET ASSY.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	14	.44	6.16	NS
	CONNECTOR, N COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR, BNC COAX.	UG-88/U	2	1.1	2.2	"
	CONNECTOR, RACK & PANEL	15 CONT. 500VAC PLSTC. INSUL. 15A MAX.	1	.56	.56	"
				SUM OF Nλ:	11.12	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY: A2	SUBASSEMBLY:	SHEET 1 OF
WLR-16				20 CY-2518D	CABINET ASSY.		

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	19	.44	8.36	N_S
	CONNECTOR, N COAX.	UG-556B/U	3	1.1	3.3	"
	CONNECTOR, BNC COAX.	UG-88/U (2) UG-260C/U (1)	3	1.1	3.3	"
	CONNECTOR, RACK & PANEL	20 CONT. PLSTC. INS. 500V 15A MAX.	1	.56	.56	"
			SUM OF N λ's		15.52	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16				21 CY-2519			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	$N\lambda$	REMARKS
	CABINET ASSY.	21A1	1	11,12	11,12	NS
	CABINET ASSY.	21A2	1	11,12	11,12	"
			SUM OF $N\lambda$'s		22,24	MTBF = 44,964 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:
WLR-16				21 CY-2519	A1 CABINET ASSY.	SHEET 1 OF —

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	14	.44	6.16	Ns
	CONNECTOR, N COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR BNC COAX.	UG-88/U	2	1.1	2.2	"
	CONNECTOR, RACK & PANEL	15 CONT. 500VAC PLSTC. INSUL. 15A MAX.	1	.56	.56	"
		SUM OF N λ's			11.12	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				21 CY-2519	A2 CABINET ASSY.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	14	.44	6.16	N_S
	CONNECTOR, N COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR, BNC. COAX.	UG-88/U	2	1.1	2.2	"
	CONNECTOR, RACK + PANEL	15 CONT. 500VAC PLSTC. INSUL. 15A MAX.	1	.56	.56	"
			SUM OF Nλ:		11.12	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-16				22 CY-2544D			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CABINET ASSY.	22A1	1	13.76	13.76	Ns
	CABINET ASSY.	22A2	1	11.12	11.12	"
			SUM OF Nλ		24.88	MTBF = 40193 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				22 CY-2544D	A1 CABINET ASSY		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM-N	CK70AW102M	20	.44	8.80	N_S
	CONNECTOR, COAX-	UG-556 B/U	2	1.1	2.2	"
	CONNECTOR, BNC COAX.	UG-88/U	2	1.1	2.2	"
	CONNECTOR RACK & PANEL	15 CONT. 500VAC PLSTC. INSUL. 15A MAX.	1	.56	.56	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				22 CY-2544D	A2 CABINET ASSY.		SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK20AW102M	14	.44	6.16	N_S
	CONNECTOR, N COAX.	UG-556 B/U	2	1.1	2.2	"
	CONNECTOR BNC COAX.	UG-88/U	2	1.1	2.2	"
	CONNECTOR RACK + PANEL	15 CONT. 500VAC PLSTC. INSUL. 15A MAX.	1	.56	.56	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				23 CY-4455			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONNECTOR, COAX.	UG-1185A/U	4	1.1	4.4	Ns
	CABLE ASSEMBLY	23A1	1	9.986	9.986	"
	CABLE ASSEMBLY	23A2	1	9.986	9.986	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-1G				23 CY-4455	A1 CABLE ASSY.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	13	.44	5.72	Ns
	"	CK72AX102M	2	.44	.88	"
	FILTER, RF	300VDC 0.05 AMP.	1	.066	.066	"
	CONNECTOR, COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR, RACK & PANEL	20 CONT. 15A MAX. 6 CONT. 7.5A MAX. 500V	2	.56	1.12	"

10001

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM: WLR-1G	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 23 CY-4455	ASSEMBLY: A2 CABLE ASSY.	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	13	.44	5.72	NS
	"	CK72AX102M	2	.44	.88	"
	FILTER, RF	300VDC 0.05 AMP.	1	.066	.066	"
	CONNECTOR, COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR RACK + PANEL	20 CONT. 15A MAX. 6 CONT. 7.5A MAX.	2	.56	1.12	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
WLR-16				24 CY-4456			SHEET 1 OF.

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONNECTOR, COAX.	UG-185A/U	4	1.1	4.4	Ns
	CABLE ASSEMBLY	24A1	1	9.986	9.986	"
	CABLE ASSEMBLY	24A2	1	10.866	10.866	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				24 CY-4456	A1 CABLE ASSY.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERM.	CK70AW102M	13	.44	5.72	Ns
	"	CK72AX102M	2	.44	.88	"
	FILTER, RF	300VDC 0.05 AMP.	1	.066	.066	"
	CONNECTOR, COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR, RACK + PANEL	20 CONT. 15A MAX. 6 CONT. 7.5A 500V MAX.	2	.56	1.12	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
WLR-16				24 CY-4456	A2 CABLE ASSY.		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, FIXED CERAM.	CK70AW102M	15	.44	6.60	Ns
	"	CK72AX102M	2	.44	.88	"
	FILTER, RF	300VDC 0.05 AMP.	1	.066	.066	"
	CONNECTOR, COAX.	UG-556B/U	2	1.1	2.2	"
	CONNECTOR, RACK & PANEL	20 CONT. 15A MAX. 500V 6 CONT. 7.5A MAX.	2	.56	1.12	"
					10.866	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 25	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
WLR-1G				CY-2522D			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, BLOWER AC	115VAC 60Hz	1	11.0	11.0	NS
	CAPACITOR, FIXED CERM.	CK70AW102M	38	.44	16.72	"
	CAPACITOR, FIXED PAPER	CP53B1FF205K	1	.016	.016	"
	CONNECTOR, COAX.	75Ω 1500VAC RMS (3) UG-556B/U (5)	8	1.1	8.8	"
	CONNECTOR, COAX.	50Ω SINGLE CONT.	5	1.1	5.5	"
	CONNECTOR, RACK & PANEL	20 CONT. PLSTC. 500VAC (2) MALE CONT. PLSTC. INS. (4)	6	.56	2.24	"

SUM OF Nλ 44.276 MTBF = 22,586 HRS

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 1/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 28	ASSEMBLY:	SUBASSEMBLY:	
WLR-1G				RADIO FREQ TRANSMISSION LINE			SHEET 1 OF __

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	SWITCH, RF (4 RELAY OPERATED POSITIONS)		2	8.892	17.784	NS
	CONN, COAX (PART OF RF SWITCH)		8	—		"
	DIODE	1N3614	2	.75	1.5	"
		SUM OF Nλ's			19.284	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 29 RADIO FREQ. TRANSMISSION LINE	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RELAY, ROTARY, COAX, SP6T		2	3.6	7.2	NS
			SUM OF N λ's		7.2	MTBF = 138,889 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 10/30/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 31	ASSEMBLY:	SUBASSEMBLY:	
WLR-1G				RADIO FREQ. TRANSMISSION LINE			SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONN. COAX (PART OF RF SWITCH)					N_s
	SWITCH, RF (2 SPDT RELAY)		1	4.446	4.446	"
	SWITCH, RF (4 RELAY OPERATED POSITIONS)		2	8.892	17.784	"
	DIODE	1N3614	2	.75	1.5	"
			SUM OF Nλ:		23.730	MTBF = 42,141 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/1/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
AS-899F							

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER (2-77)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	MOTOR, SPLIT PHASE	100W DRIVE MOTOR + INDUCTION GENERATOR	1 1	70.0 0.80	70.8	Nu
	SYNCHRO GENERATOR	TRANSMITTER 115VAC 60Hz	1	2.119	2.119	"
	CAPACITOR, FIXED PAPER	CP53BIEF205K (1) CP91BIEF105K (1)	2	.09	.18	"
	FILTER	TYPE FL53DD1EA PER MIL-F-15733D	2	.066	.132	"
	HEATER	115V, 150W	2	4.468	8.936	"
	CONNECTOR, COAX.		12	2.6	31.2	"
	CONNECTOR, CIRC.	MS-3112E-20-16PW (2) MS-3112E-20-16S (1)	3	2.0	6.0	"
	INDUCTOR, ADJ.	UNITED TRANSFORMER HVC-7 (1) HVC-12 (1)	2	.066	.132	"
	BEARING		1	20	20	"
	BEARING, BALL		7	34.4	240.8	" ← 380.3
	BEARING + PULLEY ASSY.		1 1	1.27 20	21.27	"
	SHAFT, C'RES STEEL		4	1.237	4.948	"
	TIMING BELT	FIBRE CABLE, NEOPRENE TEETH, NYLON FACING	1	4.007	4.007	"
	GEAR, SPUR	COTTON BASE PHENOLIC, HUB C'RES STEEL	2	86	172	"
	GEAR, SPUR	C'RES STEEL	1	86	86	"
	PULLEY		2	1.27	2.54	"
	GASKET, RUBBER		10	.60	6.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	DATE 11/1/72
AC-299F							SHEET 2 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	O-RING		2	.60	1.2	N_U
	SWITCH, TOGGLE	MS35039-22	1	4.0	4.0	"
	SWITCH, THERMOSTATIC	BI-METAL ELEMENT 110°F ±5° DIFF. +30° ±5°	1	2.8	2.8	"
	MULTIPLEXER		1	9.6	9.6	" MICROPHASE CORP.
	ANTENNA ASSY SPIRAL		1	9.6	9.6	" EM SYSTEMS, INC

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
C-3118							

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESOLVER, ELEC.	26V INPUT 400 Hz 565Ω 12.6V OUT 0.484 RATIO	1	55.556	55.556	NS
	SYNCHRO, REC.		1	2.119	2.119	"
	SYNCHRO, CONTROL TRANSFORMER		1	2.644	2.644	"
	CAPACITOR, FIXED ELECTRO.	2.5mf 50VDC (3) .16mf 10VDC (2)	8	3.8	30.40	" CE CAL, DIE (4)
	——	250mf 15VDC (1) .250mf 25VDC (1)	—	—	—	"
	——	.200mf 15VDC (1)	—	—	—	"
	CAPACITOR, FIXED PAPER	4700pf 300VDC	1	.016	.016	" CP
	DIODE, GERM.	JAN 1N277	2	2.5	5.0	" DF, CAL (1)
	DIODE, RECT. GERM.	1N93	2	2.5	5.0	"
	DIODE, SILICON ZENER	SV-802 TRANSITRON ELECTRONICS CORP	1	.91	.91	"
	P.C. BOARD	GLASS CLOTH EPOXY	1	.0048	.0048	"
	FUSE, CARTRIDGE	6 AMP. 250V (4) 15 AMP. 250V (2)	10	.10	1.00	"
	——	4 AMP. 250V (4)	—	—	—	"
	LAMP, NEON	NE-51	4	.20	.80	"
	LAMP, INCAN.	328	13	1.00	13.0	"
	CONNECTOR, COAX.	UG-281/U	1	1.1	1.1	"
	COIL, RF	4.7±10% uh 0.22Ω MAX. (1) 30mh 500V RMS (1)	2	.066	.132	" [illegible] (1)

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 2 OF.
C-3118							

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RELAY, THERMAL	DPDT 115VAC or 26.5VDC 15AMP MAX.	1	.746	.746	NS
	GEAR	NYLON	1	.236	.236	"
	GEAR, PINION	STAINLESS STEEL	1	.236	.236	"
	GEAR, SPUR	ALUMINUM	1	.236	.236	"
	GEAR, COUPLING SHAFT ASSY.	ALUMINUM	1	.236	.236	"
	COUPLING, FLEXIBLE	PHOSPHOR BRONZE	1	.540	.540	"
	PHOTO-DIODE	SILICON 1N2175	1	.91	.91	"
	TRANSISTOR, GERM. NPN	2N35	6	9.0	54.0	"
	RESISTOR, FIXED COMP.	RC20GF222K (5) RC20GF822K (1)	25	.039	.975	"
	———	RC20GF472K (1) RC20GF102K (4)	—	—	—	"
	———	RC20GF182K (2) RC20GF122K (1)	—	—	—	"
	———	RC20GF332K (1) RC20GF562K (1)	—	—	—	"
	———	RC20GF682K (1) RC20GF103K (2)	—	—	—	"
	———	RC20GF221K (1) RC20GF100K (2)	—	—	—	"
	———	RC30BF103K (2) RC30BF104K (1)	—	—	—	"
	RESISTOR, VAR. W.W.	3Ω 25W	1	7.5	7.5	" RP
	RESISTOR, VAR. COMP.	RV4ATRJ103A (1) RV4ATSD103A (7)	9	22.0	198.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/3/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 3 OF
C-3118							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	———	RVGLAYSA102B (1)	—	—	—	Ns
	SWITCH, SENSITIVE	SPDT, 10AMP. 125V (12) SPDT ——— (1)	61	1.1	67.10	"
	———	SPST, 10AMP. 125V (48)	—	—	—	"
	SWITCH, TOGGLE	DPST, 15AMP. 125VAC	1	.68	.68	"
	TRANSFORMER, PWR.	115V 60Hz INPUT 6.3VCT 3AMP. 2SEC.	1	.064	.064	"
	TRANSFORMER, PULSE	INTERSTAGE 427ΩDC 500V PRI. 15H SEC. 4H	1	.0083	.0083	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
AMA-1017B							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	AMP. PWR. SUPPLY ASSY.	1A1	1	83.127	83.127	N_S
	DIODE ASSY.	1A2	1	1.594	1.594	"
	DIODE ASSY.	1A3	1	1.610	1.610	"
	DIODE ASSY.	1A4	1	22.364	27.364	"
	SUM OF Nλ				113.69[illegible]	MTBF = [illegible]

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM: AM-1017B	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY: A1 AMP.-PWR. SUP.	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	DIODE, ZENER SILICON	1N964B	1	.91	.91	Ns
	DIODE, RECTIFIER SILICON	1N560	8	.75	6.00	"
	DIODE, ZENER SILICON	1N3030B	1	.91	.91	"
	CAPACITOR, FIXED ELECTRO.	CL31CH550MP3 (1) CL25BF600UP3 (1)	5	1.9	9.50	"
	———	CL25BG121UP3 (1) CL25BQ360SP3 (1)	—	—	—	"
	———	CL25BL101TP3 (1)	—	—	—	"
	TRANSISTOR, SILICON NPN	2N2222A	3	1.1	3.3	"
	TRANSISTOR, SILICON PNP	2N2907	1	1.7	1.7	"
	TRANSISTOR, SILICON NPN	2N657	4	1.1	4.4	"
	TRANSISTOR, SILICON NPN	2N3902	2	1.1	2.2	"
	RESISTOR, FIXED COMP.	RCR20GF103J (4) RCR20GF183J (1)	15	.0077	.1155	"
	———	RCR20GF223J (1) RCR20GF332J (1)	—	—	—	"
	———	RCR20GF333K (1) RCR20GF122J (3)	—	—	—	"
	———	RCR20GF222K (1) RCR20GF102K (3)	—	—	—	"
	RESISTOR, VAR.	RV6LAYS102A (1) RV4LAYSA104A (1)	2	22.0	44.0	"
	RESISTOR, VAR.	RK09UACS102	1	8.6	8.6	"
	RESISTOR, FIXED WIRE	RW55V682 (1) RW55V332 (2)	3	.43	1.29	"
					———	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE ________

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY: A1	SUBASSEMBLY:	SHEET 2 OF
AM-1017B					AMP. -PWR. SUPP.		

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RESISTOR, FIXED COMP.	RC42GF681J (1) RC42GF152K (1)	2	.039	.078	N_s
	RESISTOR, FIXED FILM	RN55D1003F (1) RN55D4322F (1)	2	.03	.06	"
	TRANSFORMER, PWR.	TF5RX03ZZ 4320V CT. PRI. 100V SEC. 550VRMS CT.	1	.064	.064	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/72

SYSTEM: AM-1017B	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY: 1A2 DIODE ASSY.	SUBASSEMBLY:	SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	DIODE, SILICON RECTIFIER	1N1204A	2	.75	1.5	Ns
	CAPACITOR, FIXED PAPER	CP53B4EF105V1	1	.016	.016	"
	RESISTOR, FIXED COMP.	RC32GF104K	2	.039	.078	"
SUM OF Nλ					1.594	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
AWI-1017B					1A3 DIODE ASSY.		SHEET 1 OF.

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	DIODE, SILICON RECTIFIER	1N1204A	2	.75	1.5	N_S
	CAPACITOR, FIXED PAPER	CP53B4EF105V1 (1) CP53B4EF504V1 (1)	2	.016	.032	"
	RESISTOR, FIXED COMP.	RC32GF104K	2	.039	.078	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/77

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
AN-1017B					1A4 DIODE ASSY.		

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS	
	DIODE, SILICON RECTIFIER	1N3190	4	.75	3.00	Ns	
	MOTOR, AC		1	11	11.0	"	BLOWER USE
	CAPACITOR, FIXED PAPER	CP70B1EF105X (1) 15uf ±20% 600VDCW (8)	9	.016	.144	"	OIL FILLED (8)
	FUSE	3AC 1A 250V	2	.10	.20	"	
	FUSE, INDICATING	ONE 15A 250V FUSE + ONE INCAN. LAMP.	1 1	.10 1.00	1.10	"	
	LAMP, NEON	NE-51	2	.20	.40	"	
	RELAY	DPST, 115VAC, 12.5A MAX.	1	5.5	5.5	"	
	REACTOR, SATURABLE	115VAC 6A INPUT, LOAD 500V WINDING 1.5Ω, CONTROL 14Ω	4	.064	.256	"	
	RESISTOR, FIXED WIRE	RW30C142	4	.43	1.72	"	
	SWITCH, TOGGLE	DPST, 5A, 125V	1	.68	.68	"	
	SWITCH, SENSITIVE	SPDT, 15A, 125V PUSH BUTTON TYPE	3	1.1	3.3	"	
	TRANSFORMER, PWR.	115VAC INPUT MULT. SEC.	1	.064	.064	"	
				SUM OF Nλ	27.364		

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
AN/WLA-3B							

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CONTROL INDICATOR	UNIT 1	1	73.112	73.112	NU
	AMPLIFIER ASSY.	UNIT 2	1	887.838	887.838	"

SUM OF Nλ: 960.950 MTBF = 1041 HRS.

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
AN/WLA-3B				1 CONTROL-IND. C-9993/WLA-3B			SHEET 1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER (QTY)	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	CAPACITOR, ELECTRO.	CE44C550N085	1	3.8	3.80	N_S
	DIODE	1N1614	4	.75	3.00	"
	LAMP, INCAND.	MS25237-327T	22	1.0	22.0	"
	FUSE	F03A250V10AS	1	0.10	.10	"
	CONNECTOR	MS3102A16 S1P (1) MS3102A22-14S (4)	5	.56	2.80	"
	REACTOR	30mH min. @15V 94Hz 3.5ADC 0.4 Ω DC RES.	1	.066	.066	"
	METER	115VAC 2.7W CONT. DUTY 9999.9 HR.	1	10.0	10.0	"
	TRANSISTOR	2N1485	1	1.1	1.1	"
	RESISTOR, VAR. COMP.	RV4NAYSD500A	1	22.0	22.0	"
	RESISTOR, FIXED COMP.	RC42GF471J (1) RC20GF391K (16)	18	.039	.702	"
	—	RC20GF821K (1)	—	—	—	"
	SWITCH, ROTARY	SINGLE SEC. 3 POS. 3 POLE	4	1.7	6.80	"
	SWITCH, TOGGLE	MS25126-8	1	.68	.68	"
	TRANSFORMER, PWR.	PRI. 115VAC 60Hz SEC. 28VAC 5A	1	.064	.064	"
						"
						"
						"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT: 2	ASSEMBLY:	SUBASSEMBLY:	SHEET 1 OF
AN/WLA-3B				AMP. ASSY. AM-6844/WLA-3B			

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	RF AMP. BAND 1	2A1 AM-6845/	1	86.459	86.459	NU
	RF AMP. BAND 2	2A2 AM-6846/	1	88.459	88.459	"
	RF AMP. BAND 3	2A3 AM-6847/	1	356.460	356.460	"
	RF AMP. BAND 4	2A4 AM-6848/	1	356.460	356.460	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
AN/WLA-3B				2 AMPLIFIER AM-6844	2A1 RF AMP. #1 AM-6845		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION: NOMENCLATURE	DEVICE IDENTIFICATION: NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	AMP., SOLID STATE	1.0 - 2.6 GHz, AVANTEK AS-154N OR WJ-780-19	1	8.0	8.0	Nu
	DIODE, MICRO. DET.	1N23	1	17.0	17.0	"
	LIMITER, COAX.	AMERICAN ELECTRONIC LAB MIC-3411	1	4.999	4.999	"
	CONNECTOR, CIRC.	MS3102E28-21P	1	2.0	2.0	"
	CONNECTOR, COAX.	1103407	5	2.6	13.0	"
	SWITCH, COAX.	SPDT COAX. SWITCH, 3 COAX. CONNECTORS, ONE SPDT MICRO-SWITCH	3	2.717	8.151	"
	RESISTOR	RC42GF271J (1) RC42GF151J (1)	2	.11	.22	"
	DIODE, MICRO. DET.	1.0-2.6 GHz 10MHz VIDEO BANDWIDTH, 100Ω, 10pf LOAD	1	17.0	17.0	" MICROPHASE CORP. CDVH032
	DIVIDER, PWR.	POLARAD ELECTRONICS CORP. 4102010	1	2.089	2.089	"
	DIODE, PIN	GEN. MICROWAVE 864H-11 OR ALPHA IND. MT-3099-99	1	14.0	14.0	"
					86.459	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	SHEET
AN/WLA-3B				2 AMPLIFIER AM-6844	2A2 RF AMP. #2 AM-6846		1 OF

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	DEVICE IDENTIFICATION NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	AMP. SOLID STATE	2.0 – 4.5 GHz, AVANTEK AS-155N OR WJ-5090-7	1	10.0	10.0	Nu
	DIODE, MICRO. DET.	1N23	1	17.0	17.0	"
	LIMITER, COAX.	AMERICAN ELECTRONIC LAB MIC-3411	1	4.999	4.999	"
	CONNECTOR, CIRC.	MS3102E28-21P	1	2.0	2.0	"
	CONNECTOR, COAX.	113407	5	2.6	13.0	"
	SWITCH. COAX.	SPDT COAX. SWITCH, 3 COAX. CONNECTORS, ONE SPDT MICRO-SWITCH	3	2.717	8.151	"
	RESISTOR	RC42GF 271J (1) RC42GF 151J (1)	2	.11	.22	"
	DIODE, MICRO. DET.	2.3 - 4.45 GHz, 10MHz VIDEO BW, 100Ω 10pF LOAD	1	17.0	17.0	" MICROPHASE CORP. CDV324AE
	DIVIDER, PWR.	POLARAD ELECTRONICS 4102022 CORP.	1	2.089	2.089	"
	DIODE, PIN	GEN. MICROWAVE 864H-11 OR ALPHA IND. MT-3099-99	1	14.0	14.0	"

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
AN/WLA-3B				2 AMPLIFIER AM-6844	2A3 RF AMP. #3 AM-6847		SHEET 1 OF –

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
	TWT AMP. 4-8 GHz	WJ-3090 OR TELEDYNE MEC M9152	1	300	300	Nu
	DIODE, MICRO. DET.	IN23	1	17.0	17.0	" ASSUMED NOT USED IN BAND 3
	CONNECTOR, CIRC.	MS3102E28-21P	1	2.0	2.0	"
	CONNECTOR, COAX.	113407	5	2.6	13.0	"
	SWITCH, COAX.	SPDT COAX. SWITCH 3 COAX. CONNECTORS, ONE SPDT MICRO-SWITCH	3	2.717	8.151	"
	RESISTOR	RC42GF271J (1) RC42GF151J (1)	2	.11	.22	"
	DIODE, MICRO. DET.	4.3-7.35 GHz, 10MHz VIDEO BW, 100Ω 10pf LOAD	1	17.0	17.0	" MICROPHASE CORP. CDV348AE
	DIVIDER, PWR.	POLARAD ELECTRONICS 3102146 CORP.	1	2.089	2.089	"
	DIODE, PIN	GEN. MICROWAVE 864H-11 OR ALPHA IND. MT-3099-99	1	14.0	14.0	"
					356.460	

INHERENT RELIABILITY ANALYSIS WORKSHEET

DATE 11/2/78

SYSTEM:	SUBSYSTEM:	EQUIPMENT:	GROUP:	UNIT:	ASSEMBLY:	SUBASSEMBLY:	
AN/ULA-3B				2 AMPLIFIER AM-6844	2A4 RF AMP. #4 AM-6848		SHEET 1 OF _

INDEX NUMBER	DEVICE IDENTIFICATION NOMENCLATURE	NUMBER	QUANTITY N	FAILURE RATE λ	Nλ	REMARKS
AR1	TWT AMP. 7-11 GHZ	WJ-3041, TELEDYNE MEC M9162 OR LITTON M9162	1	300.0	300	NU
	DIODE, MICRO DET.	1N23	1	17.0	17.0	" ASSUMED NOT USED IN BAND 4
	CONNECTOR, CIRC.	MS3102E28-21P	1	2.0	2.0	"
	CONNECTOR, COAX.	113407	5	2.6	13.0	"
K1, K2, K3	SWITCH, COAX.	SPDT COAX. SWITCH, 3 COAX. CONNECTORS, ONE SPDT MICRO-SWITCH	3	2.717	8.151	"
	RESISTOR	RC42GF271J (1) RC42GF151J (1)	2	.11	.22	"
CR1	DIODE, MICRO. DET.	7.05-10.75 GHZ, 10MHZ VIDEO BW, 100~10PF LOAD	1	17.0	17.0	" MICROPHASE CORP. CDV3812AE
Z1	DIVIDER, PWR.	POLARAD ELECTRONICS 5102179 CORP.	1	2.089	2.089	"
	DIODE, PIN	GEN. MICROWAVE 864H-11 OR ALPHA IND. MT-3099-99	1	14.0	14.0	"

PART CLASS: SWITCH

DESCRIPTION: STEPPING

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
GROUND DORMANT	0.4		
SHIPBOARD NAVAL SHELTERED	3.6		

Multiplicative Application Factors for Environment

Environment:	Shipboard SHELTERED	DORMANT GROUND
Factor:	9.0*	1.0

Failure Definition:

* FACTOR BASED ON MIL-HDBK-217B

PART CLASS: SWITCHES

DESCRIPTION: COAXIAL

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
GROUND	0.247		
SHIPBOARD NAVAL UNSHELTERED	2.717		
SHIPBOARD NAVAL SHELTERED	2.223		

Multiplicative Application Factors for Environment

Environment:	Shipboard UNSHELTERED	SHELTERED
Factor:	11*	9*

Failure Definition:

* FACTOR BASED ON MIL-HDBK-217B RELAY ENVIRONMENTAL FACTORS

PART CLASS: SYNCHROS + RESOLVERS

DESCRIPTION: SYNCHRO CONTROL TRANSFORMER

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
AIRBORNE	9.032		
SHIPBOARD	2.644 *		

Multiplicative Application Factors for Environment

Environment:	Shipboard	AIRBORNE
Factor:	1*	3.42

Failure Definition: * FACTOR BASED ON SYNCHRO CONTROL TRANSMITTER RATES, RADC-TR-75-22

PART CLASS: SYNCHROS + RESOLVERS

DESCRIPTION: SYNCHRO RECEIVER/TRANSMITTER

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
AIRBORNE	7.246		
SHIPBOARD	2.119 *		

Multiplicative Application Factors
for Environment

Environment:	Shipboard	AIRBORNE
Factor:	1 *	3.42

Failure Definition: * FACTOR BASED ON SYNCHRO CONTROL TRANSMITTER RATES, RADC-TR-75-22

PART CLASS: SYNCHROS + RESOLVERS

DESCRIPTION: SYNCHRO RECEIVER/TRANSMITTER

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
AIRBORNE	7.246		
SHIPBOARD	2.119 *		

Multiplicative Application Factors for Environment

Environment:	Shipboard	AIRBORNE
Factor:	1 *	3.42

Failure Definition: * FACTOR BASED ON SYNCHRO CONTROL TRANSMITTER RATES, RADC - TR - 75-22

PART CLASS:

DESCRIPTION: IC VOLTAGE REGULATOR

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
SHIPBOARD	0.103 *		

Multiplicative Application Factors
for Environment

Environment: Shipboard

Factor: 1

Failure Definition: BASED ON AN/SLQ-32 FAILURE PREDICTION DATA FOR SIMILIAR ITEMS

2A1A13-1R1 845688-1 0.103 (V)3 REG, IC SLQ-32

PART CLASS:

DESCRIPTION: LIMITER

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
SHIPBOARD	4.999 *		

Multiplicative Application Factors for Environment

Environment: Shipboard

Factor: 1

Failure Definition: BASED ON AN/SLQ-32 FAILURE PREDICTION DATA FOR SIMILIAR ITEMS

2A1A13AR1 848471-1 4.999 (V)3 LIMITER, SLQ-32

PART CLASS:

DESCRIPTION: POWER DIVIDER

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
SHIPBOARD	2.089 *		

Multiplicative Application Factors
for Environment

Environment: Shipboard

Factor: 1

Failure Definition: BASED ON AN/SLQ-32 FAILURE PREDICTION DATA FOR SIMILIAR ITEMS

1A3A13A1 848368-1 1.788 (V)2, (V)3
20A11A6 DC2-3 570935-2 2.389 ALL SUITES
} PWR. DIVIDERS SLQ-32

PART CLASS:

DESCRIPTION: THERMOSTATIC SWITCHES

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
SHIPBOARD, N_S	0.40		
SHIPBOARD, N_u	2.80		

Multiplicative Application Factors
for Environment

Environment:	Shipboard, N_S	SHIPBOARD, N_u
Factor:	1	7

Failure Definition: BASED ON MECHANICAL DESIGN AND SYSTEMS HANDBOOK, TABLE 18.3. N_u, UPPER EXTREME N_S, LOWER EXTREME.

PART CLASS: MECHANISMS, POWER TRANSMITTAL

DESCRIPTION: PULLEY,

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
GROUND	1,27 *		
SHIPBOARD, Nu	1,27 *		
GROUND, MOBILE	39,279		

Multiplicative Application Factors for Environment

Environment:	Nu Shipboard	GROUND	GROUND, MOBILE
Factor:	1	1	31,02

Failure Definition: * BASED ON RADC-TR-75-22 SHAFT DATA

PART CLASS: MECHANISMS, POWER TRANSMITTAL

DESCRIPTION: SHAFT

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
GROUND	1.237		
SHIPBOARD, Nm	1.237 *		

Multiplicative Application Factors for Environment

Environment:	Nm Shipboard	GROUND
Factor:	1	1

Failure Definition: * BASED ON RADC TR-75-22

PART CLASS: MECHANISM, POWER TRANSMITTAL

DESCRIPTION: FAN BELT

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval LOWER LIMIT	UPPER LIMIT
GROUND	4.007		
SHIPBOARD, Nm	4.007 *		

Multiplicative Application Factors for Environment

Environment:	Nm Shipboard	GROUND
Factor:	1	1

Failure Definition: * BASED ON RADC TR-75-22

PART CLASS: HEATERS, ELECTRICAL

DESCRIPTION: GENERAL

FUNCTION:

ENVIRONMENT	FAILURE RATE Failures Per 10^6 Part-Hours (λ)	FAILURE RATE CONFIDENCE LIMITS 90% Interval	
		LOWER LIMIT	UPPER LIMIT
GROUND, MOBILE	4.468		
SHIPBOARD, NM	4.468 *		

Multiplicative Application Factors for Environment

Environment:	NM Shipboard	GROUND, MOBILE
Factor:	1	1

Failure Definition: * BASED ON RADC-TR-75-22

Unique Component Failure Rate Estimate (cont.)

UNITS 6,7,8,9 A3 MIXER (WLR-1G)

STRIPLINE MICROWAVE STRUCTURE CONSISTING OF :

NEGLIGIBLE	2 -	3DB HYBRID COUPLERS
2×17 = 34	2 -	MICROWAVE DIODES (BALANCED MIXER CONFIG.)
* 4×13 42	1 -	2 STAGE TRANSISTOR AMP.
NEGLIGIBLE	1 -	10 DB DIRECTIONAL COUPLER
1×13 = 13	1 -	DIODE DETECTOR
89×10^{-6}		

FROM SECTION 3-70 WLR-1G TECH. MANUAL

* ASSUMED 1 TRANSISTOR = 2 DIODES

Unique Component Failure Rate Estimate

MTO-101 & 102 MICROWAVE OSCILLATOR
MFG. BY TEXSCAN CORPORATION, BANDS 6+7

RELIABILITY MODEL:

*2 × 13 = 26	1 -	Si MICROWAVE DETECTOR TRANSISTOR *
6 × .13 = .78	6 -	Film Resistors RL
2 × .066 = .132	2 -	RF Coils
2 × .25 = .50	2 -	Feed through caps (assume CY Equiv.)
27.412 × 10-6		

GT-101 ‡ RCA S47671
MFG TEXSCAN

BANDS 8+9

RELIABILITY MODEL

.10	1 -	TUNED VARIABLE CAVITY
2.0	1 -	GAs FET ‡
2.10 × 10-6		

* ASSUMED 1 TRANSISTOR = 2 DIODES

‡ FROM W-J 780-19 DATA

Unique Component Failure Rate Estimate (cont.)

WJ 5090-7 Amplifier

Obsolete, replaced by Ga As FET
Estimated Reliability per Watkins Johnson
Appox. 100,100 hours, 10×10^{-6} λ

consists of:
- 8 FETS
- 8 Caps
- 4 diodes
- 8 resistors

WJ 780-19 Amp

Equivalent to 4 Ga As FET
Estimated Reliability per Watkins Johnson
125,000 hours, $\lambda = 8 \times 10^{-6}$

MT-3099-99 MICOWAVE SWITCH, ALPHA IND.

CONNECTOR & SWITCH
Estimated Reliability 70,000 hours per Alpha Industries,

APPENDIX C

WLR-1G MAINTAINABILITY PREDICTION WORKSHEETS

MAINTAINABILITY ANALYSIS

AS-599F ANTENA

REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Sheet ____ of ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS: LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
MOTOR			71	.106	1.7	.094	2.0	0.134	1.4	.124	5.5	391
SYNCHRO			2.1	.106	1.7	.094	2.0	0.134	1.4	.124	5.5	11.5
CAPACITOR			.18	.106	1.7	.094	.081	0.34	0.00	.124	2.24	.4
FILTER			.13	.106	1.7	.094	.081	0.134	0.00	.124	2.24	.3
HEATER			8.9	.106	2.0	.094	1.0	0.134	0.00	.124	3.5	31.1
CONN, COAX			31	.106	1.7	.094	.103	0.134	0.00	.124	2.27	70.4
CONN, CIR			6	.106	1.7	.094	.103	0.134	0.00	.124	2.27	13.6
INDUCTOR			.13	.106	1.7	.094	1.75	0.134	0.00	.124	3.91	.51
BEARING			260.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.5	1695
BEARING/PULLEY			21.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.5	138
SHAFT			4.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.5	32
TIMING BELT			4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.5	26
PULLEY			2.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.5	16
GEAR			258	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.5	1677
SWITCH			6.8	.106	1.7	.094	.103	.134	0.00	.124	2.27	15.4
MULTIPLEXER			9.6	.106	1.7	.094	1.75	.134	0.00	.124	3.91	37.5
ANTENNA, SPIRAL			9.6	.106	1.7	.094	3.0	.134	0.00	.124	5.2	50
		ΣNλ	696.9								ΣNλR_p	4206

6.0

MAINTAINABILITY ANALYSIS

ITEM CONTROL I[illegible] C-3118 Sheet 1 of ____

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT		
CALIBRATOR, DE PARTS	1		95.65	.106	1.7	.094	.125	.034	2.0	.124	4.18	399.2
RELAY	1		.746	.106	1.7	.094	.125	.034	0.00	.124	2.18	1.6
GEAR	4		.944	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	4
COUPLING	1		.54	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	2
RESISTOR, VAR	9		183.5	.106	1.7	.094	.125	.034	2.0	.124	4.18	767.0
SWITCH, SENSITIVE	61		67.1	.106	1.7	2.0	1.0	1.5	2.0	.124	8.43	565.6
SWITCH TOGGLE	1		.68	.106	1.7	.094	.125	.034	0.00	.124	2.18	1.5
TRANSFORMER	2		.0723	.106	1.7	.094	.305	.034	0.00	.124	2.36	.17
RESOLVER	1		55.5	.106	2.5	1.0	.5	1.0	2.0	.124	7.23	401.3
SYNCHRO	2		4.7	.106	2.5	1.0	.5	1.0	2.0	.124	7.23	33.9
CAPACITOR	4		15.2	.106	1.7	.094	.125	.034	2.0	.124	4.18	63.9
DIODE	3		8.4	.106	1.7	.094	.125	.034	2.0	.124	4.18	35.1
FUSE	10		1.0	.106	0.00	0.00	.01	0.00	0.00	0.00	.116	.116
LAMP	17		13.8	.106	0.00	0.00	.01	0.00	0.00	0.00	.116	1.6
CONN COAX	1		1.1	.106	1.7	.094	.125	.034	0.00	.124	2.1[illegible]	[illegible]
COIL, RF	1		.1066	.106	1.7	.094	.125	.034	2.0	.124	2.18	.14
											5.1	
		$\Sigma N\lambda$	449								$\Sigma N\lambda R_p$	2279.

MAINTAINABILITY ANALYSIS

ITEM AMPLIFIER, AN/-1017B

Sheet ____ of ____

METHOD OF REPAIR: Replace-Parts X   Subassembly ____   Assembly ____   Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT		
AMP-PWR SUP. A1 PARTS	1		83.1	.106	1.569	0.5	.125	0.5	2.0	.124	4.9	407.19
DIODE ASSEMBLY A2 & 3 PARTS	2		3.2	.106	1.569	0.5	.081	0.5	2.0	.124	4.87	15.55
DIODE ASSEMB. A4 PARTS	1		27.36	.106	1.569	1.0	.125	1.0	2.0	.124	5.9	161.42
											5.1	

$\Sigma N\lambda$ 113.7 $\Sigma N\lambda R_p$ 584.16

MAINTAINABILITY ANALYSIS

ITEM AN/WLA-35 Sheet ____ of ____

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT		
CONTROL IND	1		73.1								1.03	75.29
AMPLIFIER ASSEMBLY	1		381.8								5.7	2176
			ΣNλ 454.9								ΣNλR	2251

MAINTAINABILITY ANALYSIS

ITEM V.I.A.3.F Cont. Indicator (Unit 1) Sheet ____ of ____

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
CAPACITOR			3.8	.089	.772	.094	.125	.134	0.00	.138	1.35	5.15
DIODE			3	.089	.772	.094	.125	.134	100	.138	1.35	4.05
LAMP			22				.015				.015	.33
FUSE			.1	.089	.772		.01				.01	.001
CONN, CIR			2.8	.089	.772	.094	.269	.134	0.00	.138	1.49	4.17
REACTOR			.06	.089	.772	.094	.125	.134	0.00	.138	1.35	.08
METER			10	.089	.772	.094	.125	.134	0.00	.138	1.35	13.5
TRANSISTOR			1	.089	.772	.094	.159	.134	0.00	.138	1.38	1.38
RESISTOR, VAR			22	.089	.772	.094	.159	.134	0.00	.138	1.38	30.36
RESISTOR			.7	.089	.772	.094	.125	.134	0.00	.138	1.35	.95
SWITCH, ROTARY			6.8	.089	.772	.094	.9	.134	0.00	.138	2.15	14.5
SWITCH, TOGGLE			.68	.089	.772	.094	.125	.134	0.00	.138	1.35	.92
TRANSFORMER			.06	.089	.772	.094	.305	.134	0.00	.138	1.53	.09

$\Sigma N\lambda$ 73 $\Sigma N\lambda R_p$ 75.46

MAINTAINABILITY ANALYSIS

ITEM U--36 AMPLIFIER UNIT 2 Sheet ____ of ____

METHOD OF REPAIR: Replace-Parts ____ Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT		
RF AMP BAND 1											5.7	
RF AMP BAND 2											5.7	
RF AMP BAND 3											5.7	
RF AMP BAND 4											5.7	
		$\Sigma N\lambda$									$\Sigma N\lambda R_p$	

WLA-3B, RF AMP ASSEMBLY

MAINTAINABILITY ANALYSIS

ITEM 2A1, RF AMP AM-6845

Sheet ____ of ____

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT		
SOLID STATE AMP (TW[illegible]			300	.45	0.294	2.5	.125	2.5	0.00	.062	5.63	1689
DIODE* (Not used)			[illegible]	.073	.772	2.5	.081	2.5	0.00	.062	5.99	[illegible]
CO[illegible] [illegible]R			2	.045	.394	2.5	.125	2.5	0.00	.062	5.63	11
CO[illegible] COA[illegible]			13	.045	.394	2.5	.125	2.5	0.00	.062	5.63	73
S[illegible] COAX			8	.045	.394	2.5	.125	2.5	0.00	.062	5.63	45
RES[illegible]ER*			.2	.073	.772	2.5	.081	2.5	0.00	.062	5.99	1.198
DIO[illegible] [illegible] DET			17	.045	.394	2.5	.125	2.5	0.00	.062	5.63	96
DIV[illegible]ER [illegible]			2	.045	.394	2.5	.125	2.5	0.00	.062	5.63	11
PIN D[illegible]E			14	.045	.394	2.5	.125	2.5	0.00	.062	5.63	79
* [illegible] PART LEVEL												

ΣNλ ~~[illegible]~~ 356

ΣNλR_p ~~587~~ 2005

MAINTAINABILITY ANALYSIS

ITEM VII-3B, REPAIR ASSEMBLY AN/-6845(24) Sheet ____ of ____

METHOD OF REPAIR: Replace-Parts ____ Subassembly X Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS: LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
SOLID STATE AMP (TWT)			8	.029	0.265	2.5	.125	2.5	0.00	.062	5.48	43.84
DIODE*			17	.029	.772	2.5	.081	2.5	0.00	.062	5.99	[illegible]
LIN [illegible] COAX			5	.029	.265	2.5	.125	3.5	0.00	.062	5.48	27.4
CONN CIR			2	.029	.265	2.5	.125	2.5	0.00	.062	5.48	10.96
CONN COAX			13	.029	.265	2.5	.125	2.5	0.00	.062	5.48	71.24
SWITCH COAX			8	.029	.265	2.5	.125	2.5	0.00	.062	5.97	43.89
RESISTOR*			2	.073	.772	2.5	.081	2.5	0.00	.062	5.90	11.98
DIODE MICRO DET			17	.029	.265	2.5	.125	2.5	0.00	.062	[illegible]	93.16
DIVIDER, PWR			2	.029	.265	2.5	.125	2.5	0.00	.062	[illegible]	[illegible]
PIN DIODE			14	.029	.265	2.5	.125	2.5	0.00	.062	5.48	76.72
* = Part [illegible]												
		ΣNλ	86								ΣNλR	481.15

MAINTAINABILITY ANALYSIS

[illegible]: WLR - 1

[illegible] Subassembly ____ Assembly ____ Sheet ____ of ____ Unit ____

[illegible] ITEM	N	[illegible]	ND	LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT	R_p	$NA\ R_p$
				AVERAGE MAINTENANCE TASK TIMES, HOURS								
Converter - Tuner	9		3395								2.35	7978.25
RF Switch, SA-604C, 608C	3		53								2.2	116.6
RF Switch, SA 616	1		7.2								2.48	17.8
FREQ. Converter, CV741	1		988.9								4.79	4737
FREQ. Discriminator, R?89	1		994								1.8	1789
FREQ. Converter, CV742	1		1112								5.1	5671
Azimuth Indicator	1		3425								3.16	10823
Control Storer	1		9.22								3.2	2950
Power Supply	1		7.94								2.2	1744
Power Supply	1		1343								2.25	3022
Inter connect Box	1		54								2.28	123
Equipment Rack	6		168	Estim. Same as 15415 (PP2156 cabinet)							2.3	386
											3.045	
			[illegible] 13,256								[illegible]	40,361

MAINTAINABILITY ANALYSIS

ITEM CONVERTER UNIT CV-462(-/URT)　　　Sheet 1 of 2

METHOD OF REPAIR: Replace-Parts X　　Subassembly ____　　Assembly X　　Unit ____

	REPLACEABLE ITEM	N	λ	Nλ	LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT	R_p	$N\lambda R_p$
					AVERAGE MAINTENANCE TASK TIMES, HOURS								
A1	[illegible]												
A2	DETECTOR	1		3.70	.075	.315	.094	.044	.134	1.75	.108	2.52	9.3240
A3	MIXER	1		89.0	.075	.315	.094	.242	.134	1.75	.108	2.78	241.9020
A4	OSCILLATOR	1		5.61	.075	.315	.094	.110	.134	1.75	.108	2.586	14.50746
A5	POWER SUPPLY	1		30.436	.075	.315	[illegible]	.196	[illegible]	1.021	.108	.9	26.70142
A6	GEAR DRIVE	1		59.132	.075	.315	[illegible]	[illegible]	.134	1.75	.108	2.78	164.7207
A7	PREAMP			48.571	.075	.315	[illegible]	.066	.134	1.08	.108	1.872	91.48512
A8	FRONT PANEL			NEGL.	.075	.315	.094	[illegible]	[illegible]	.200	.108	.792	—
A9	NOT USED												
A10	PRESET CAM	1		14.40	.075	.315	.094	.066	.134	1.75	.108	2.542	36.60480
A11	OSC CAM	1		11.60	.075	.315	.094	.066	.134	1.75	.108	2.542	29.48720

$\Sigma N\lambda$ 262.719　　　$\Sigma N\lambda R_p$ 612.73389

MAINTAINABILITY ANALYSIS

ITEM [illegible] CV 116[illegible]

Sheet 2 of 2

METHOD OF REPAIR: Replace-Parts ____ Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS: LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
ATTENUATOR, COAX	1		1.5	.165	1.7	.094	.044	.134	0.00	.108	2.[illegible]45	3.3675
CONNECTOR, RACK	1		.56	.165	1.7	.094	.421	.134	0.00	.108	2.6[illegible]	1.46832
METER [illegible]	1		10.0				.088		0.00	0.108	2.289	22.8400
RESISTOR [illegible]	3		66.0				.191		0.00	.1[illegible]	2.392	157.8720
SWITCH TOGGLE	1		.68				.191		0.00	.1[illegible]	2.3[illegible]	1.62656
TRANSFORMER	1		.064				.305		0.00	.108	2.506	1.60384
CAPACITOR, ELECT	1		1.9				.081		0.00	.108	2.28[illegible]	4.3358
Gear Spur			3.48								2.5	8.7
		ΣNλ	346.9								$\Sigma N\lambda R_p$	814.6

MAINTAINABILITY ANALYSIS

ITEM [illegible] SWITCH, S[illegible]

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Sheet 1 of ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT		
SWITCH, RF	2		17.8	.15	.772	.094	1.0	.134	0.00	[illegible]	2.28	40.58
DIODE	2		1.5	.15	.772	.094	.081	.134	0.00	[illegible]	1.369	2.05

$\Sigma N\lambda$ 19.3 $\Sigma N\lambda R_p$ 42.63

MAINTAINABILITY ANALYSIS

ITEM [illegible]

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Sheet ____ of ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS							R_p	$N\lambda R_p$
				LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT		
Rotary Switch K105	2		7.2	0.15	[illegible]	.165	1.0	.262	0.0	.138	2.48	17.856
		ΣNλ									$\Sigma N\lambda R_p$	

MAINTAINABILITY ANALYSIS

FREQUENCY DISCRIMINATOR RF-2 Sheet 1 of 2

Subassembly ____ Assembly X Unit ____

FUNCTIONAL ITEM	N	λ	Nλ	LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	F_p	$N\lambda F_p$
				AVERAGE MAINTENANCE TASK TIMES, HOURS								
FREQ. CONV. (A1)			181.205	.075	.315	.094	.044	.134	1.0	.108	1.77	320.732
160 MHz Li[illegible] (A2)			289.910	.075	.315	.094	.044	.134	1.5	.108	2.27	658.0957
AFC (A3)			217.260	.075	.315	.094	.044	.134	.75	.108	1.45	314.9777
11 MHz Discriminator (A4)			159.846	.075	.315	.094	.044	.134	1.0	.108	1.77	282.9274
Amplifier (A5)			13.62	.075	.315	.094	.044	.134	.25	.108	1.02	13.1944
		ΣNλ	—								ΣNλFp	—

AD-A072 056 EVALUATION RESEARCH CORP SAN DIEGO CA F/G 17/4
AVAILABILITY STUDY OF THE AN/WLR-1G AND AN/SLQ-32(V)2 ELECTRONI--ETC(U)
FEB 79 J VALENZUELA, W EICHELBERGER N66001-78-R-0318
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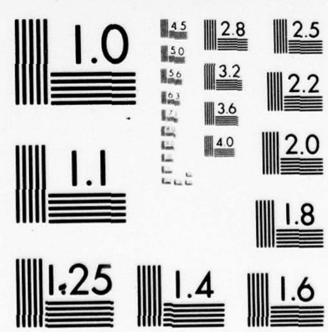


MICROCOPY RESOLUTION TEST CHART

MAINTAINABILITY ANALYSIS

Z.F.G. Discriminator RF-89 — Sheet 2 of 21

Method II Detail: Subassembly: X — Subassembly ____ — Assembly ____ — Unit ____

REPLACEABLE ITEM	N	λ	Nλ	LOCALIZE	ISOLATION	DIS-ASSEM	INTERCHANGE	RE-ASSEM	ALIGN	CHECK-OUT	$\bar{R}_p$	$N\lambda \bar{R}_p$
TRANSFORMER			.164	.165	1.7	.094	.281	.134	1.5	.108	3.98	2.5472
CONNECTOR			10.46	.165	1.7	.094	.269	.134	1.5	.108	3.97	41.526
CAPACITOR			4.856	.165	1.7	.094	.147	.134	0.0	.108	2.348	11.40188
			1.6			.044						3.592

The task-time columns, LOCALIZE through CHECK-OUT, are printed under the heading AVERAGE MAINTENANCE TASK TIMES, HOURS.

ΣNλ 994 — ΣNλ$\bar{R}_p$ 1767

MAINTAINABILITY ANALYSIS

ITEM FREQ. CO[illegible] CV-742 Sheet 1 of 2

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	AVERAGE MAINTENANCE TASK TIMES, HOURS: LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
IF PREAMP, A1	1		406.09	.075	.315	.094	.044	.134	4.1	.108	4.87	1977.683
OSCILLATOR-MIXER, A2	1		452.728	.075	.315	.094	.509	.134	4.1	.108	5.34	2417.67[illegible]
		$\Sigma N\lambda$	—								$\Sigma N\lambda R_p$	—

MAINTAINABILITY ANALYSIS

ITEM E.F.D. Conv[illegible] CV-742 Sheet 2 of 2.

METHOD OF REPAIR: Replace-Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT	R_p	$N\lambda R_p$
CAP[illegible]			16.344	.121	1.179	.094	.081	.134	4.1	.108	6.382	104.3074
DIODE			2.25	.121	1.179	.094	.081	.134	4.1	.108	6.382	14.3595
RF COIL			.792	.121	1.179	.094	.081	.134	4.1	.108	6.3[illegible]	5.054[illegible]
RESISTOR, [illegible]			.319	.121	1.179	.094	.081	.134	4.1	.108	6.38[illegible]	2.035858
TUBE			162.5	.121	1.179	.094	.081	.134	4.1	.108	6.3[illegible]	1037.0750
CONNECTOR RACK	2	12 CONNECTIONS	1.12	.121	1.179	.094	.465	.134	4.1	.108	6.766	7.57792
CONNECTOR, COAX			2.2	.121	1.179	.094	.103	.134	.5	.108	2.8	6.16
RELAY		2 screws	1.6	.121	1.179	.094	.044	.134	0.00	.108	2.245	3.5920
RESISTER, VARIABLE		1 screw 3 CONN	66.0	.121	1.179	.094	.137	.134	4.1	.108	2.838	187.308C
TRANSFORMER, IF		4 screws 4 CONN	.132	.121	1.179	.094	.537	.134	4.1	.108	6.538	0.863016
TRANSFORMER, [illegible] OTHER		4 screws 6 CONN	.064	.121	1.179	.094	.305	.134	0.00	.108	2.506	1.60384
											52.001 / 11	4.73

$\Sigma N\lambda$ 1112 $\Sigma N\lambda R_p$ 5765

MAINTAINABILITY ANALYSIS

ITEM A7 UNIT - INDICATOR, I-4??

METHOD OF REPAIR: Replace-Parts ______ Subassembly ______ Assembly ______

Sheet ____ of ____ Unit ______

REPLACEABLE ITEM	N	λ	Nλ	LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
A1 VIDEO AMP			224	.075	.315	.094	.044	.134	2.3	.108	3.07	688
A2 PAN OR AMIC AMP			206	.075	.315	.094	.044	.134	.75	.108	1.5	309
A3 0-5 MSEC SWEEP			320	.075	.315	.094	.044	.134	1.1	.108	1.87	598
A4 PULSE STRETCH-FL			349	.075	.315	.094	.044	.134	2.08	.108	2.85	994
A5 5-500 MSEC SWEEP			30-	.075	.315	.094	.044	.134	1.75	.108	2.52	-61
A6 NOT USED			-	-	-		NOT	USED		-	-	-
A7 05-50K MSEC SWEEP			244	.075	.315	.094	.044	.134	2.1	.108	2.87	700.22
A8 HORIZ-VERT AMP			218	.075	.315	.094	.044	.134	2.3	.108	3.07	669.26
A9 DC TYPE AMP			169	.075	.315	.094	.044	.134	1.1	.108	1.87	316.
A10 SCAN VIDEO			182	.075	.315	.094	.044	.134	1.25	.108	2.02	368
A11 DC/SCAN SELECTOR			1.6	.075	.315	.094	.044	.134	1.5	.108	2.27	3.6
A12 SCAN DEFLECTION			215	.075	.315	.094	.044	.134	1.5	.108	2.27	488
A13 FREQ. INDICATOR			496	[illegible]	.315	2.0	0.6	2.0	.5	.108	5.826	2331
A14 [illegible] SERVO AMP			183	.075	.315	2.0	.088	2.0	.5	.108	1.314	239
A15 ELECT. CABINET			11	.075	.315	2.0	0.15	2.0	0.00	.108	.814	9
CHASSIS PARTS			411								4.0	1644
		ΣNλ	349								ΣNλRp	11018

MAINTAINABILITY ANALYSIS

[illegible] -2694 Sheet 1 of 2

[illegible] Subassembly ____ Assembly X Unit ____

					AVERAGE MAINTENANCE TASK TIMES, HOURS								
[illegible]	[illegible]	λ	N	LOCALIZE	ISOLATION	DIS-ASSEM	INTERCHANGE	RE-ASSEM	ALIGN	CHECK-OUT	$\bar{M}_p$	$N\bar{M}_p$
A1 SERVO UNIT, [illegible]			503	.075	.315	.094	.688	.134	[illegible]	.108	[illegible]	1097
A2 CABINET, ELECT.			1.1	.075	.315	.094	0.264	.134	.00	.108	0.856	.94

C-2627

X

Sheet 2 of 2

AVERAGE MAINTENANCE TASK TIMES, HOUR

PART DESCRIPTION	N	λ	Nλ	LOCALIZATION	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT	R_p	Nλ R_p
CAPACITOR			.03	.165	1.7	.094	.125	.134	1.0	.108	3.326	.099
DIODE			.75	.165	1.7	.094	.081	.134	1.0	.108	3.282	2.46
LAMP			21	.165	1.7	.094	1.0	.134	0.00	.108	3.201	67.2
CON[illegible]			1.7	.165	1.7	.094	.269	.134	1.0	.108	3.47	5.890
RELAY			1.6	.165	1.7	.094	.044	.134	0.00	.108	2.245	3.592
RESISTOR, [illegible]			.1	.165	1.7	.094	.081	.134	1.0	.108	3.282	.3282
RESISTOR, WIRE WOUND			17.2	.165	1.7	.094	.5	.134	2.0	.108	5.[illegible]	93.74
RESISTOR, VARIABLE			250	.165	1.7	.094	.225	.134	1.5	.108	3.0[illegible]	[illegible]
SWITCH, ROTARY			6.8	.165	1.7	.094	.9	.134	0.00	.108	3.[illegible]	21.054
SWITCH, TOGGLE			1.4	.165	1.7	.094	1.02	.134	0.00	.108	3.[illegible]	4.4
SWITCH, SENS.			23.1	.165	1.7	.094	2.0	.134	1.0	.108	5.2	120.12
TRANS[illegible]			.06	.165	1.7	.094	.281	.134	0.00	.108	2.482	1.4892
MAGNETIC CLUTCH				.165	1.7	.094	2.5	.134	1.5	.108	6.2	130.2
GEAR				.165	1.7	.094	1.0	.134	1.5	.108	4.7	23.03
COUPLINGS				.165	1.7	.094	1.0	.134	1.5	.108	4.7	2.35
BEARING				.165	1.7	.094	1.0	.134	1.5	.108	4.7	32.9
RESISTOR, VAR. PREC	10		61	.165	1.7	.094	2.5	.134	1.5	.108	6.2	379.2
		TOTAL	922								TOTAL	2967.505

MAINTAINABILITY ANALYSIS

ITEM POWER SUPPLY, PP-2156D Sheet 1 of 1

METHOD OF REPAIR: Replace-Parts Y Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
				AVERAGE MAINTENANCE TASK TIMES, HOURS								
CAPACITOR (2 CONN. 2 SCREWS TYPICAL)			.17[illegible]	.089	1.7	.094	.125	.134	.021	.108	2.27	0.43584
FUSE (FRONT PANEL)			0.67	.089	1.7	.094	.01	.134	.021	.108	2.2	1.474
RELAY (2 SCREWS)	4		6.4	.089	1.7	.094	.022	.134	.021	.108	2.2	14.08
CHOKE (4 SCREWS, 2 CONN.)			.264	.089	1.7	.094	.164	.134	.021	.108	2.3	0.6072
METER (15 SCREWS, 2 CONN.)			10	.089	1.7	.094	.411	.134	.021	.108	2.6	26.0
RESISTER FIXED (2 CONN.)			7.727	.089	1.7	.094	.081	.134	.021	.108	2.2	16.9994
SWITCH, ROTARY			1.7	.089	1.7	.094	.327	.134	.021	.108	2.5	4.25
SWITCH TOGGLE			0.68	[illegible]	1.7	.094	.137	.134	.021	.108	2.3	1.564
SWITCH P/B			.47	.089	1.7	.094	.137	.134	.021	.108	2.3	1.081
TRANSFORMER	5		.32	.089	1.7	.094	.269	.134	.021	.108	2.4	0.768
TUBE			650	.089	1.7	.094	.015	.134	.021	.108	2.2	1430.0
FAN (BLOWER)			11	.089	1.7	.094	.191	.134	.021	.108	2.3	25.3
CAPACITOR			.032	.089	1.7	.094	.125	.134	.021	.108	2.2	0.0704
RFI FILTER			.064	.089	1.7	.094	.125	.134	.021	.108	2.3	0.1472
RELAY, THERMAL	1	30	40	.089	1.7	.094	.159	.134	.021	.108	2.3	0.920
RESISTER, VARIABLE	4		.88	.089	1.7	.094	.445	.134	.021	.108	2.6	2.288
DIODE			16.5	.089	1.7	.094	.125	.134	[illegible]	.108	2.3	37.95
		ΣNλ	707.298								$\Sigma N\lambda R_p$ 2.32	1563.9350

MAINTAINABILITY ANALYSIS

ITEM POWER SUPPLY PP-2157D — Sheet 1 of 1

METHOD OF REPAIR: Replace-Parts X — Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N	λ	Nλ	LOCALIZE	ISOLATION	DISASSEM	INTERCHANGE	REASSEM	ALIGN	CHECKOUT	R_p	$N\lambda R_p$
				AVERAGE MAINTENANCE TASK TIMES, HOURS								
CAPACITOR			1.082	.089	1.7	.094	.125	.134	0.021	.108	2.27	2.46
DIODE			27.0	.089	1.7	.094	.125	.134	0.021	.108	2.27	61.29
LAMP			3.0	.089	1.7	.094	.191	.134	0.021	.108	2.3	6.90
SWITCH (DIB)			0.92	.089	1.7	.094	.137	.134	0.021	.108	2.3	2.116
FUSE			0.6	.089	1.7	.094	.01	.134	0.021	.108	2.2	1.32
RELAY			4.8	.089	1.7	.094	.022	.134	0.021	.108	2.2	10.56
REACTOR (CHOKE)			.33	.089	1.7	.094	.169	.134	0.021	.108	2.3	.759
VOLTMETER			10	.089	1.7	.094	.111	.134	0.021	.108	2.6	26
RESISTOR			12.1	.089	.7	.094	.081	.134	0.021	.108	2.2	26.62
RESISTOR, VARIABLE			132	.089	.7	.094	.445	.134	0.021	.108	2.6	343
SWITCH, ROTARY			1.7	.089	.7	.094	.327	.134	0.021	.108	2.5	4.25
SWITCH TOGGLE			1.14	.089	.7	.094	.137	.134	0.021	.108	2.3	2.6
TRANSFORMER			.38	.089	.7	.094	.269	.134	0.021	.108	2.4	.91
TUBE			1136	.089	.7	.094	.015	.134	0.021	.108	2.2	2499
MOTOR			11	.089	.7	.094	.191	.134	0.021	.108	2.3	25.3
CAPACITOR			.128	.089	.7	.094	.125	.134	0.021	.108	2.27	.29
		ΣNλ	1342								ΣNλR 2.3	3013

MAINTAINABILITY ANALYSIS

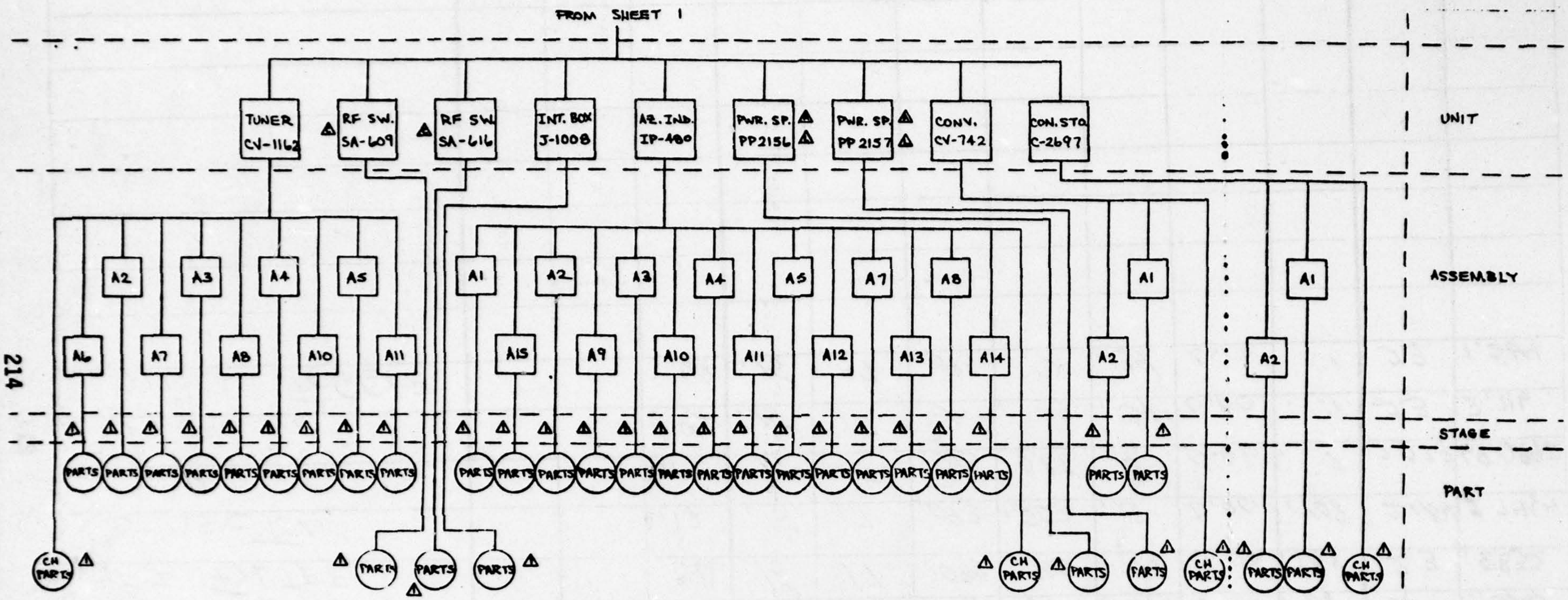
ITEM: [illegible]

Sheet 1 of 1

METHOD OF REPAIR: Replace Parts X Subassembly ____ Assembly ____ Unit ____

REPLACEABLE ITEM	N		Nλ	LOCAL-IZE	ISOLA-TION	DIS-ASSEM	INTER-CHANGE	RE-ASSEM	ALIGN	CHECK-OUT	R_p	$N\lambda R_p$
DIODE			.75	.15	1.7	.093	.081	.134	0.00	.108	2.266	1.69956
LAMP			1.6	.15	1.7	.093	.147	.134	0.00	.108	2.332	3.7312
FUSE			0.6	.15	1.7	.093	.01	.134	0.00	.108	2.20	1.320
RFI FILTER			.384	.15	1.7	.093	.103	.134	0.00	.108	2.3	.8832
CONNECTOR			1.12	.15	1.7	.093	.264	.134	0.00	.108	2.454	2.7484
RELAY			30.4	.15	1.7	.093	.088	.134	0.00	.108	2.273	69.0992
SWITCH TIP			0.92	.15	1.7	.093	.123	.134	0.00	.108	2.3	2.116
SWITCH TOGGLE			.68	.15	1.7	.093	.123	.134	0.00	.108	2.3	1.564

ΣNλ 36.454 ΣNλR_p 93.16150

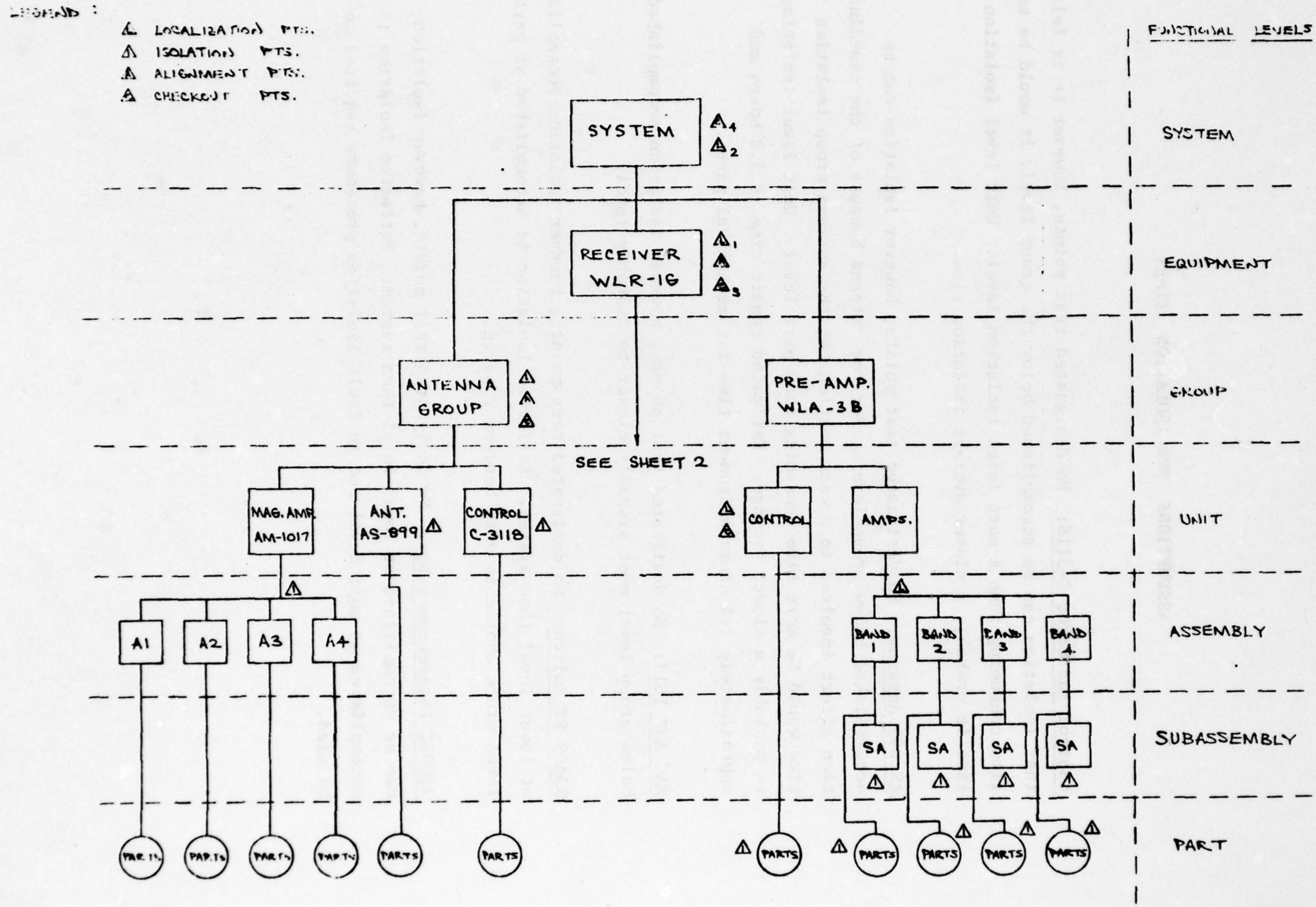


LEGEND :

- LOCALIZATION PTS.
- ISOLATION PTS.
- ALIGNMENT PTS.
- CHECKOUT PTS.

NOTES :

1. CV-1162, IP-480, CV-742, C-2697 ARE LOCALIZED TO THE EQUIPMENT LEVEL
2. SA-609, SA-616, J1008 ARE LOCALIZED TO THE SYSTEM LEVEL.
3. J1008, IP-480, PP-2156, PP-2157, CV-742, C-2697 ARE CHECKED OUT AT THE EQUIPMENT LEVEL
4. CV-1162 IS CHECKED OUT AT THE SYSTEM LEVEL


LEGEND :
LOCALIZATION PTS.
ISOLATION PTS.
ALIGNMENT PTS.
CHECKOUT PTS.
FUNCTIONAL LEVELS
SYSTEM
EQUIPMENT
GROUP
UNIT
ASSEMBLY
SUBASSEMBLY
PART
SYSTEM
RECEIVER WLR-16
ANTENNA GROUP
PRE-AMP. WLA-3B
SEE SHEET 2
MAG. AMP. AM-1017
ANT. AS-899
CONTROL C-3118
CONTROL
AMPS.
A1
A2
A3
A4
BAND 1
BAND 2
BAND 3
BAND 4
SA
SA
SA
SA
PARTS
PARTS
PARTS
PARTS
PARTS
PARTS
PARTS
PARTS
PARTS
PARTS
PARTS

ASSUMPTIONS FOR ISOLATION TIMES

Control Indicator C-3118: No designated test points, however it is felt that isolation can be accomplished below the group level. It would be more time consuming than a part level isolation level. Unit level isolation time is probably a closer average isolation time.

AS 899 Antenna: No designated test points, however isolation can be accomplished below group level. For the antenna because of the coordination effort involved to access portions of the antenna group isolation time would be more time consuming than part level. Unit level isolation is probably a closer average. Estimated repair time is 5.0 hours and approximately 1.5 hours alignment time for mechanical parts.

MAG AMP 1017: No designated test points, however isolation accomplished below group level most probably closer to assenbly level.

SA609 RF Switch: No designated test points, however isolation accomplished at lower level than system. Estimated isolation is accomplished at part level since choice is only between 2 parts.

J1008C Interconnect Box: No designated test points, however isolation can be accomplished at lower level than system. Estimated isolation is accomplished at unit level due to fault isolation procedure required to be used.

ESTIMATED INTERCHANGE TIMES

COMPONENT	DETAILED STEP	ELEMENT TIME	TIMES PERFORMED	INTERCHANGE TIME (HRS.)
CONTROL STORER	Remove A3 assembly			)
MAGNETIC CLUTCH,	Remove coupling			)
PRECISION VARIABLE	Remove cable clamp			)
RESISTOR	Unsolder wires			)
	Remove clutch from pot shaft			) 2.5 est.
	Solder wires			)
	Fasten coupling			)
	Fasten cable clamp			)
	Re-install A3 assembly			)
CONTROL STORER	Remove A3 assembly			
GEAR COUPLING,	Disassemble gear train			2.5
bearing	Remove gear			
	Instakk gear			1.0 hrs. est.
	Ressemble gear train			
	Re-install A3			

ESTIMATED INTERCHANGE TIMES (cont.)

COMPONENT	DETAILED STEP	ELEMENT TIME	TIMES PERFORMED	INTERCHANGE TIME (HRS)
RFSWITCH RELAY				1.0 total estimated
RACK CONVERTER	Unsoldered wire	.0058	20	.116
	Remove screws	.0093	2	.0186
	Install screws	.0093	2	.0186
	Solder wire	.0058	20	.116
				.2692
ROTARY SWITCH	Unsolder 17 wires	.0058	17	.0986
	Remove 7 screws	.0093	7	.0651
	Solder wires	.0058	17	.0986
	Install screws	.0093	7	.0651
				.3274
TRANSFORMER	Unsolder wires	.0058	12	.0696
	Remove screws	.0093	4	.0651
	Solder wires	.0058	12	.0696
	Replace screws	.0093	4	.0651
CONTROL STORER	Remove A4 assembly			.2694
LAMPS	Disassemble/Re-assemble A4			
				1.0 hrs. est.

ESTIMATED INTERCHANGE TIMES (cont.)

COMPONENT	DETAILED STEP	ELEMENT TIME	TIMES PERFORMED	INTERCHANGE TIME(HRS.)
CONTROL STORER	Remove switch	.25 estimated		.25
ROTARY SWITCH	Unsolder wires	.10 estimated total		.10
	Solder wires	.20 estimated total		.20
	Re-install switch	.35 estimated		.35
				0.9
CONTROL STORER	Remove switch	.5 estimated		.5
TOGGLE SWITCH	Unsolder wires	.01 estimated total		.01
	Solder wires	.01 estimated total		.01
	Re-install switch	.50 estimated		.50
				1.02
CONTROL STORER	Remove A4		)	
	Disassemble A4		)	
	Unsolder wires		))	2.0 hrs. est.
	Remove switch		)	
	Install switch		)	
	Solder wires		)	
	Reassemble A4		)	
	Re-install A4		)	
				2.0

ESTIMATED ACCESS TIMES FOR UNIQUE COMPONENTS

AN/WLA-3B	Mast Mounted Coordinate s/down of equip.=1-2 hrs.=1.5 hr. Coordinate turn-on= 1.0 hr.
AMPLIFIER SECTION	MAST MOUNTED ACCESS 1 hr. Access,cut potting,pull amp , = 1 hr. Easy to isolate,very often run out of TWA's Check out- minimum Install pannels & pot connector=1.5 hr.
CONTROL INDICATOR	In CIC space (below),everything easy to access and fault isolate = total 1 hr. lamps outside.
CONTROL IND. C3118	Micro switch are most difficult to access, time 2.0 hrs. Total time may be 4 hrs. Pull front pannel & other parts.
RESOLVERS	Long time to isolate x 1hr.-3hrs. for loose conn. Alignment time= 1.5 to 2.0 hrs. Front pannel difficult to isolate XFMR difficult to isolate
MAG AMP	Low knowledge of theory of op. 1A1 faults long time to isolate 2-4 hrs. Access time for back parts blower & coils take long time=1hr. Other near parts=.5 hr.

ESTIMATED ACCESS TIME FOR UNIQUE COMPONENTS (cont.)

Alignment time 2 hr. time 1AR1 difficult to set for proper

rotation starts at the group level

ESTIMATED ALIGNMENT TIMES

AZIMUTH INDICATOR, IP-480

15min equip. warm-up.

Time min.	A. 0-5 Microsec sweep
5min.	1) Connect pulse Gen.
3min.	2) Adjust intensity,focus,position and sync level.
1	3) Adjust 0-5 trigger A3R16 for stabble pulse.
3	4) If required, adjust sync range by adjusting gain, sync range sync level for max noise deflection.
1	5) Adjust A4R11 for base line sweep position
3	6) Adjust A3R20 for 6 pulses.
3	7) Adjust A3R16,30 for 6 pulses if required.
6	8) Adjust A3R38,50 for observation @ begin & end of sweep.
2	9) Adjust A3R20 for 6th pulse @ leading edge.
3	10) Adjust R16
3	11) Adjust R20
3	12) Adjust R30
5	13) Repeat Adjusting of R20, 16,30,38,50.
3	14) Adjust R50
3	15) Adjust 38
3	16) Adjust C14
3	17) Adjust R20
53min.	

AZIMUTH INDICATOR, IP-480 (cont.)

Time min.		
	B.	5-400 Microsec Sweep
		1) Make adjustment A. first
		2) Approximately 70% complexity of Adjustment A.
37		
	C.	.5 K to 50 K Microsec Sweep
		1) Make adjustment A.
		2) Make adjustment B.
20		3) Approximately 50% complexity of Adjustment B.
	D.	Sync Range
3		See step 4 Adj A.
	E.	Pan Display
30		see adj. A of Swept Oscill, CV742 Adjustments
	F.	Scan display alignment ⇒ used only when V2 is replaced
60		Approximately same complexity as Adj. A.
	F.F.	Scan Display align, minor adjustment
40		approximately 70% complexity adj. F
	G.	DF display alignment
		1) Adj. sync range first
		2) 11 scan diaplay first
25		3) Approximately 40% complexity of F Adj.

FREQUENCY CONVERTER CV742

Equ. 15 min. - Equipment warm-up

160 MHZ IF

Time min.		
15	1)	Connect Sig Gen, Test Coupler, UOM
15	2)	Adjust Gain control knob for VOM Indication
6	3)	Adjust L9, 18, 76 for max deflection @ 160 MHZ
6	4)	Adjust 5, 15, 12 for max deflection @ 148 MHZ
6	5)	Adjust 3, 2, 19 for max deflection @ 172 MHZ
9	6)	Repent steps 3, 4, 5 for refinement.
10	7)	Record & plot on graph paper 10 frequency Vs Amp P. data points
15	8)	Re-adjust L9, 18, 26 to obtain flat response if required
82		
10	9)	Disconnect equipment
92		
		Isolation Amp
15	1)	Similar to 1 above
15	2)	Similar to 2 above
5	3)	Adjust L2 for lowest dip resurance point
35		
		39 MHZ IF - Narrow band
15	1)	Remove tube
15	2)	Similar to 1) above
15	3)	Similar to 2) above
5	4)	Adjust T1 & T2 for min. reading
35	5)	Replace tube
		Fix Oscill.
	1)	same as 2) above
	2)	same as 2) above
	3)	Adjust L17 for min deflection
35		

Swept Oscill.

A. Align Panoramic Display (unit 12)

Time min.		
15	1)	Set switch positions - 5
15	2)	Remove cover on Unit 10 & 11
15	3)	Connect scope to Unit 10
15	4)	Select band with shortest sweep
6	5)	Adjust R3, R7 for proper pan sweep
6	6)	Adjust R13, R7, R37, for centered and intensity sweep
3	7)	Adjust R22/R18 on either unit 10/11 for pan sweep
45		

B. Oscill. Align.

3	1)	Connect Sig. Gen., Test Coupler, VOM
3	2)	Adjust gain
3	3)	Remove tube
3	4)	Adjust L5 for min deflection @ 160 MHZ
3	5)	Adjust R25 for max deflection@ 150 MHZ
3	6)	" " " " " " 170 "
3	7)	" L13, 14, 15 for max deflection @ 170 MHZ
5	8)	Repeat steps 5, 6, 7, for refinement
3	9)	Adjust R25 for max deflection @ 160 MHZ
3	10)	Adjust R26 " " " " " "
	11)	Replace tube
2	12)	Adjust gain control for pan display
3	13)	" R25 " " "
3	14)	" R33 " " " @ 150 MHZ
3	15)	" L5 " " " $\leq$ 150 "

Time min.	Swept Oscill.					
3	16)	Adjust	R25 for pan display			@ 160 MHZ
3	17)	"	R33 "	"	"	" 170 "
3	18)	"	R26 "	"	"	centered
3	19)	"	R29 "	"	"	" left @ 155 MHZ
3	20)	"	R26, 29 for pan display			" right $\leq$ 165 MHZ
3	21)	Tighten 4 lock nuts, disconnect equipment				
10		DISCONNECT EQUIPMENT				
65						

2 min. min - Test equipment access time

to

20 min. max.

CONTROL STORER, C-2697

1) Tighten & loosen appropriate gear set screws

2) Align pot rotation

3) Hold pot alignments and mesh gear train at stop

1.0 hr.

4) Secure gear set screws

5) Index control knob to proper position

6) Check mechnical interlock adjustment

Magnetic Clutches & Pots

1) Remo-e friction busing set screws

2) Adjust manual tune control

.5 hr.

3) Adjust friction drag by adjusting set screws

4) Repeat adjustment until pot shaft responds correctly to associated select P/B.

Tuner Servo Alignment

1) Connect Sig. Gen. and Oscilloscope

2) Adjust Servo gain by adjusting R32, 44, 46

3) " Pos. control by adjusting R34, R44

.75 hr. 4) " R32 & R44 to minimize jitter

5) Repeat to achieve max. gain with min. jitter

6) Connect sig. gen. to Unit 8

7) Adjust Unit 8 input controls

8) Adjust gain pot R32 & R44 to obtain correct signal bloom display on panoramic display

CONTROL STORER, C-2697 (cont.)

Scan Gain Adjustment

	1) Set G pots to CCW position - major align.
0.25 hr(mm)	2) Rotate band selector and determine which band has highest noise level - major align.
0.45 hr (major)	3) Adjust Gain for optimum noise display
	4) Adjust scan gain pots to obtain optimum noise display on each band.

CV 1162 ALIGNMENT

PRE-SEL

	1) Adjust all cam eccentrics to be parallel to plate
10 min.	2) Conn. multimeter sig. gen.
to	3) Disconn. Antenna
15 min.	4) Cal. sign. gen for frequency using wavemeter @ Ant. Input
	5) Adjust each eccentric for proper frequency
3 min. x 9	
40 min.	
	6) Conn Sweep Gen to Ant. Input
	7) Conn. Crystal Det.
10 min	
to	8) Conn video out to scope
15 min.	9) Set cam eccentric to lowest position
	10) Set eccentric for symmetric band pass
3 min. x 9	
40 min	
5 min	Disconn Test equip.
85 min	
20 min	Test Equipment warm up
105 min	

PRE-AMP ALIGNMENT

1) Rotate tunning slug fully CCW

2) Connect Radio test set AN/TRM-3 (1 cable)

3) Calibrate to 20 MHZ

10 min. 4) Loosen lock screw on Resonator & adjust to Sync for 240 MHZ marker.

5) Adjust tunning slug for min-amplitude

6) Connect fixed atten., Detector and dummy load

7) Set sig. Gen to 400 MHZ

8) Adjust C1, 1, 10, 16, L7, L10, L20, Ti, T2, T3 for max. amplitude

9) Adjust C17 for center frequency

30 min.

10) Adjust C16 for peak @ 40 MHZ

11) Adjust T3, L20 for peak @ 390 "

" T2, L20 " " @ 410 "

12) " L10 for flat response

13) Trim up all adjustments

5 min. 15) Discount all equipment

20 min. Equipment warm-up

ESTIMATED ALIGNMENT TIMES FOR ANTENNA GROUP COMPONENTS

A. SYNCHRO COUPLING

5min.	(1) Set synchro shaft.
5min.	(2) Set synchro coupling.
10min.	(3) Instsll synchro and align with datum points.
20min.	

B. SYNCHRO ALIGNMENT

5min.	(1) Loosen 6 screws on mounting clamp.
2min.	(2) Align reflector to bench marks and arrow.
5min.	(3) Rotate synchro for 0 movement.
5min.	(4) Secure synchro.
17min.	

C. AM-1017B/SLR ALIGNMENT

1min.	(1) Set gain pot. on magnetic amplifier CCW.
1min.	(2) Set control indicator selector switches.
5min.	(3) Energize control indicator and measure voltages at TP2.
3min.	(4) Adjust mag. amp. R15 for minimum voltage reading.
3min.	(5) Adjust mag. amp, R15 for mimimum voltage reading.
5min.	(6) Repeat 4) & 5) for balance reading less than 1.0V.
5min.	(7) Adjust mag. amp. pot. R1 for maximum voltage reading.
5min.	(8) Adjust Control Ind. error pot for proper antenna rotation overshoot.
5min.	(9) Repeat 1-8 if required to achieve proper overshoot.
33min.	

ESTIMATED ALIGNMENT TIMES FOR ANTENNA GROUP COMPONENTS (cont.)

D. BELT TENSION ADJUSTMENT

15min. (1) Increase tension for maximum rotation by moving MP1225.

In addition to corrective maintenance, the technician will also perform preventive mantenance (PMS) when such actions are scheduled. A summary of the recomended PMS checks in the technical manual are listed below. Those specified on the maintenance index page (MIP) are shown together with the maintenance time. A summation of the indicated MIP maintenance times over a one year period totals 137.8 hours.

PMS

DAILY WLR - Check power supply voltage using built in meters

- Check oscillator current on all tuners using oscillator inject meter
- Check grass levels on all tuners using IP-480 pan trace
- Check audio output from IP-480

AM-1017B - Measure maximum antenna speed

- Check antenna response and drift

WEEKLY WLR-1 - Check power supply voltages

- Check C-2697 storage channels
- Check calibration of IP-480 sweeps
- Measure AC input line voltage

MONTHLY WLR-1 - Clean air filters (MIP, 1.0 hr.)

- Test CV-741 and CV-742 coverters (MIP, 3.5 hr.)
- Test tuners for sensitivity and frequency accuracy (MIP, 6.4 hr.)

C-3118 - Test operation

- Check antenna alignment

AM-1017B - Clean filter and inspect

- Measure input and output signal levels

WLA-3B - Clean and inspect

- Operational check, measure small signal gain for each band

<u>QUARTERLY</u> WLR-1 - Clean and inspect (MIP, 1.5 hr.)

- Check RF-89, FM discriminator

AS-899 - Test Antenna operation

<u>SEMI-ANNUALLY</u> WLR-1 - Lubricate tuners and Control Storer. (MIP, 0.5 hr.)

- Check RF switch insertion losses

AS-899 - Lube and inspect

<u>ANNUALLY</u> AS-899 - VSWR Tests

General Purpose Test Equipment For the WLR-1G

CATEGORY	RECOMMENDED EQUIPMENT
Multimeter	AN/PSM-4
Electronic Multimeter	AN/USM-116
Differential Voltmeter (DC VTVM)	CCUH-825A
Signal Generator	AN/URM-26B
	AN/URM-49A
	AN/URM-62A
	AN/URM-61A
	AN/URM-52A
	CAQI-620A
Sweep Generator	AN/TRM-3
Oscilloscope	AN/USM-140 or
	AN/USM-105A
Test Coupler (Part of MK-442D/ WLR-1) (Unit 30)	30A2
Power Meter	AN/USM-177
Frequency Meter	CAOI-536A
	CAQI-537A
Multimeters	AN/USM-34 ME-6( )/U
Oscilloscope	AN/USM-24
Signal Generator	AN/USM-27
Radio Test Set	TS-907/ULR
Pulse Generator	HP-214A
X-Y, Recorder	Moseley H01-135C
Sweep Generator	Alfred 650
Sweep Generator Tuning Unit	Alfred 651
Sweep Generator Tuning Unit	Alfred 652
Sweep Generator Tuning Unit	Alfred 653
Sweep Generator Tuning Unit	Alfred 654

APPENDIX D

AVAILABILITY MATH MODELS

Inherent Availability Model

The availability math model used to compute the inherent availability for the AN/WLR-1G is given by,

$$A_i = \frac{\mu_i+[\lambda_i\ e^{-t(\mu i + \lambda i)}]}{\mu i + \lambda i}$$

$$A_s = \prod_{i=1}^{N} A_i \cdot A_{5,6} \qquad \text{for } N= 1, 2, 3, 4, 7 - 14$$

where: A_i = Availability of the ith block

A_s = System Inherent Availability

λ_i = Failures/10^6 hours for ith block

μ_i = 1/MTTR of ith block

t = Time in hours

For the redundant blocks 5, 6

$$\mu_{5,6} = \mu_5 = \mu_6 = \frac{1}{5.0 \text{ hours}}$$

and by use of equations 3-3 and 3-4,

$$\int_0^\infty R_{5,6}(t)dt = \int_0^\infty [e^{-\lambda_5 t} + e^{-\lambda_6 t} - e^{-(\lambda_5 + \lambda_6)t}]dt \qquad [3\text{-}3]$$

$$MTBF_{5,6} = \frac{1}{\lambda_5} + \frac{1}{\lambda_6} - \frac{1}{\lambda_{5}+\lambda_6} \qquad [3\text{-}4]$$

the availability of blocks 5,6 is given by,

$$A_{5,6} = \frac{\mu_{5,6} + [\frac{1}{MTBF_{5,6}}]\ [e^{-at} + e^{-bt} - e^{-ct}]}{\mu_{5,6} + \frac{1}{MTBF_{5,6}}}$$

where: $a = \lambda_5 + \mu_5$

$b = \lambda_6 + \mu_6$

$c = \lambda_5 + \lambda_6 + \mu_5 + \mu_6$

Operational Availability Model

The availability math model used to compute the operational availability for the AN/WLR-1G is given by,

$$A_i = \frac{\mu_i + [\lambda_i \; e^{-t(\mu i + \lambda i)}]}{\mu_i + \lambda_i}$$

$$A_o = \prod_{i=1}^{N} A_i$$

where: A_i = Availability of ith block

A_o = System Operational Availability

λ_i = Failures/10^6 hours for ith block

μ_i = 1/MDT of ith block

t = 8760 hours

Operational Availability was computed only for an 8760 hour period since the logistics delay is derived as an average over 1 year. The values of λ and μ are all taken directly from Tables 3-8, 3-9, 3-10 and 3-11 for the respective modes of operation. No redundancy equations are required for blocks 5 and 6 since the model is for total mode required to be in an up condition.

Inherent Availability Model

The availability math model used to compute the inherent availability for the AN/SLQ-32(V)2 is given by,

$$A_i = \frac{\mu_i + [\lambda i \; e^{-t(\mu i + \lambda i)}]}{\mu_i + \lambda_i}$$

$$A_s = \prod_{i=1}^{N} A_i$$

where: A_i = Availability of the ith block

A_s = System Inherent Availability

λ_i = Failures/10^6 hours for ith block

μ_i = 1/MTTR of ith block

t = Time in hours

For the blocks A, B, C and D, λ_i is determined by the equations,

$$\lambda_i = \frac{1}{\int_0^\infty R_i(t)dt} \quad \text{for } i = A, B, C\ D$$

$$\text{where: } R_i(t) \quad \sum_{j=k}^{m} \binom{m}{k} P(t)^k \; [k-P(t)]^{m-k}$$

$$P(t) = e^{-\lambda_i t}$$

k out of m are required

The values for λ and MTTR are taken from Tables 4-9, 10, 11 and 12 for the respective modes of operation.

Operational Availability Model

The availability math model used to compute the operational availability for the SLQ-32(V)2 is given by,

$$A_i = \frac{\mu_i + [\lambda i\ e^{-t(\mu i + \lambda i)}]}{\mu_i + \lambda_i}$$

$$A_o = \prod_{i=1}^{N} A_i$$

where: A_i = Availability of ith block

A_o = System Operational Availability

λ_i = Failures/10^6 hours for ith block

μ_i = 1/MDT of ith block

t = 8760 hours

Operational Availability was computed only for an 8760 hour period since the logistics delay was assumed to be the same as for the AN/WLR-1G. The values of MTTR and λ are taken directly from Tables 4- , 4- , 4- and 4- . For the blocks A, B, C and D, the value of λ is given by,

$$\lambda_n = (F/10^6 \text{ hours})(\text{total parallel paths})(\text{Qty used})$$

for n = A, B, C, D

The failure rates given in the tables are for one of each parallel path so that, for example, the total failure rate of block A (considering no redundancy) is,

$$\lambda_A = (1.183)(38)(4) = 179.8\ f/10^6 \text{ hours}$$